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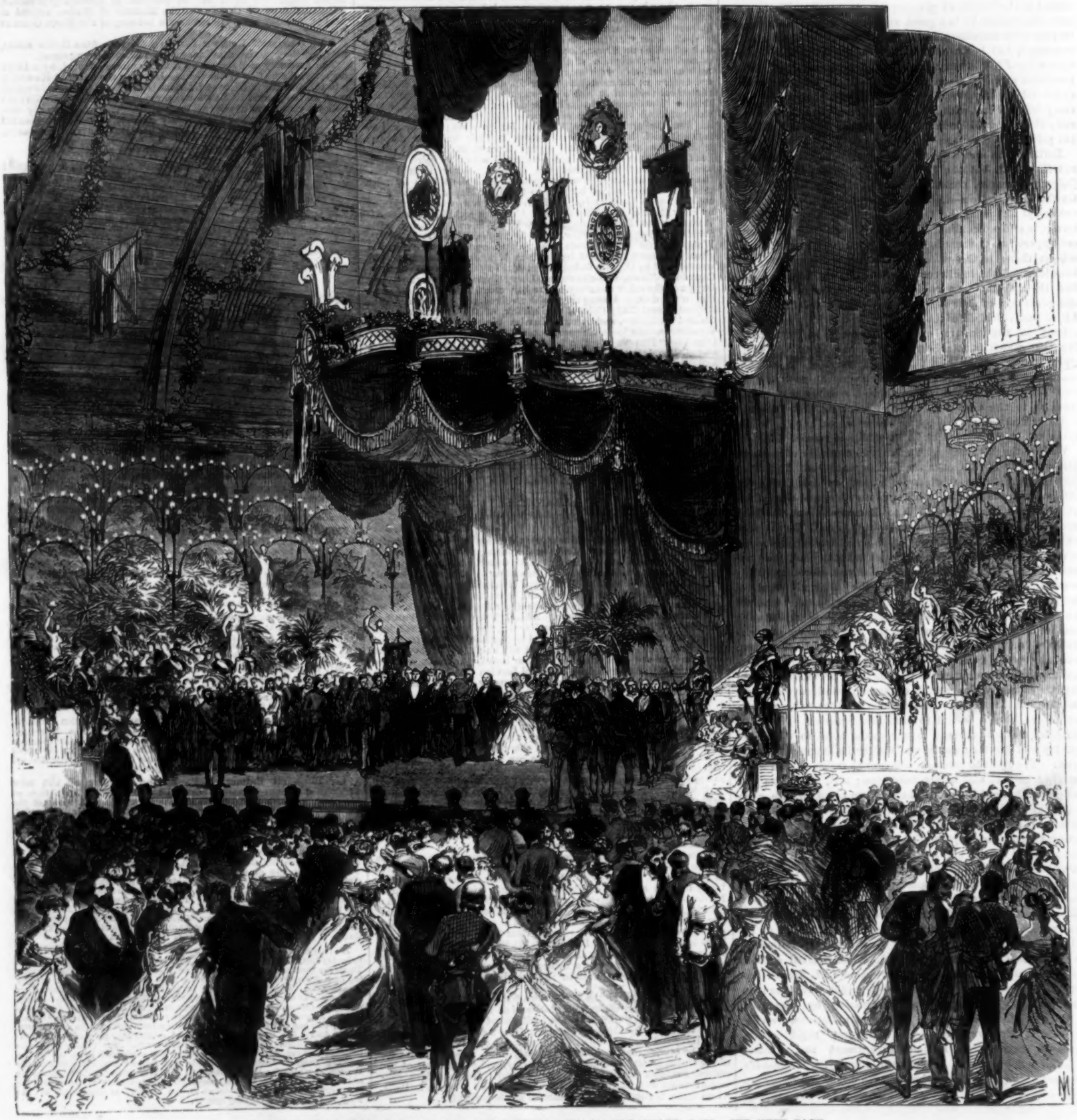


NATIONAL VOLUNTEER BALL AT THE AGRICULTURAL HALL: THE GRAND DAIS.—SEE NEXT PAGE.

GARIBALDI AND RATTAZZI.

Under cover of the two names we have put at the head of these remarks we propose to pass in rapid review the recent events which have attracted towards Italy once more the anxious attention of Europe. The fixed resolution of Garibaldi to go to Rome, his arrest by the Italian Government, his confinement, as a sort of State prisoner, within the narrow limits of his island home, and the political crisis which these events have hurried on present one of the most singular of modern historical phenomena, deserving, and even demanding, the most dispassionate and unbiassed study.

Garibaldi is the most perfect impersonation of Italy's heart and will that it is possible for human imagination to conceive. Apart from his country, his life has no purpose. Italy is the soul of which he is the living expression. His bosom throbs only in obedience to the impulses which she originates. He is not so much the interpreter of her intellectual convictions, as the incarnation of her feelings, her aspirations, her resolution. He has no ends of his own to serve; he is, so far as we know, the rarest instance of self-abnegation which this age has produced; and therefore he is the most complete, the truest, and the most thrilling organ of utterance by which the irrepressible yearnings of his beloved fatherland can make themselves audible to the world. When he waits, Italy possesses herself in patience. When he acts, his decision and his deeds are simply the outward form in which her passionate longings find suitable embodiment. The impulse is always from her, and his deeds are but the visible representation of its direction and its force. Hence, the enormous moral power he wields. Hence, also, his ability to remove from his path obstacles which any other man might regard as the height of presumption to assail. He inspires awe, not because he is a great strategist, nor because he can employ with matchless skill the physical force which is at his command, but because the soul of twenty millions of people makes itself felt in what he wills, and says, and does. When Garibaldi made up his mind to go to Rome, and by conquest or by self-immolation to claim it for Italy, he knew he would carry Italy's heart with him, and that he would be seeking an end, the accomplishment of which is the intensest desire of her political and national life.

Rattazzi, on the other hand, may be regarded as representing, not the heart, but the brain of Italy. Subtlety, prudence, judgment, reason, constitute his instruments of action. In Garibaldi Italy feels—in Rattazzi Italy thinks. The latter is not so apt a type of the intellectual side of his nation as the former is of its emotional side. Cavour was; but no country can expect two Cavours in one generation. Nevertheless, the soberer thoughts, the wider outlook, the more cautious deliberation, and the intelligent, if reluctant, conviction of Italy find their ultimate expression in the statesman as really as the yearnings of her heart become visible in the patriot. As in individual life the most generous impulses should submit to the control of the judgment, so in national life that which is most earnestly craved has to defer its claims to that which may be wisely attempted. Patriot and statesman may desire the same thing—in the case of Italy we believe they do—but, where there is a difference between them as to the time and mode of reaching their common end, the intellectual must govern the moral, or, in other words, will must, in the last resort, be amenable to reason.

Within the last fortnight these two elements of national life have been in conflict in the Italian peninsula. That Italy should desire to be mistress of herself by completing her national unity is both natural and reasonable, and Garibaldi's resolution to throw himself into Rome was but the form into which that desire spontaneously shaped itself. But a desire which overlooks all hindrances, all objections, all ulterior evils to which its efforts at realising its object may lead, does not justify itself by its mere intensity. Between Rome and Italy stood the September Convention—the pledged word of the Italian Government, its solemn engagement to secure the remnant of the Papal kingdom against molestation from without, on condition that the French army of occupation were withdrawn from Italian territory. It may have been an open question whether the policy to which, three years ago, the Government of that day was prevailed upon to assent was one which would eventually conduce to Italy's welfare; but it is not an open question whether, having given her assent, she is bound to fulfil her promise. Not even Garibaldi could be allowed to tear up the bond to which his country had become a party, and scatter its fragments to the wind. The right to proclaim war cannot reside at the same time in a subject and in his Sovereign; and, when the last has given his word for peace, the first can plead no title, even in the name of patriotism, to set it at nought. Reason and conscience are called upon by a potential voice to put a restraint upon the impetuosity of desire which disregards obligations of honour and loyalty.

Garibaldi, however, is not wholly without excuse. He was not the first to disturb the September Convention. There had been some tampering with it by a greater Power than Italy before he stirred. The French army of occupation had been loyally withdrawn from Rome, but a sufficient number of its disbanded soldiers found their way back to the dominions of the Church to overawe insurrection, and constituted a force which seemed at least to have the benefit of French inspection. There was an appearance—it might have been no more than an appearance—of an evasion by one side of the strict fulfilment of treaty stipulations, whilst the other side was kept to the most rigid observance of them. The Italian Government had ground for suspicion, and for diplomatic inquiry. Garibaldi's more impetuous nature saw what he took to be ample reason for something beyond. To tear aside the veil of overhanging mystery by instant action presented itself to his mind as the only course likely to prove effectual; and, regardless of himself, he resolved that Rome should be stirred by the pulsation of Italy's heart, and should share, by means of his presence and enthusiasm, her political and national life. He made no secret of his purpose. He needed no remonstrances. He started on his unbidden and romantic enterprise. He was quietly placed under arrest and conveyed back to Caprera, where, doubtless, he will be compelled to remain.

It was a bold step for Rattazzi to take, but it was one which it behoved him to take. The head must govern the heart. Passion may occasionally clear the way to triumph where cool judgment would refuse to move. But nations cannot allow passion, however patriotic, to snatch the sceptre of authority from reason. Had Garibaldi reached Rome he would but have precipitated a conflict between Italy and France. The afterclap would have been ruinous. As matters now stand, there is room for the hope that diplomacy will eventually compass the end which lawless force is ever on the watch to achieve. A way will perhaps be found to put the temporal sovereignty of the Pope under the guardianship of the Italian Crown, until events not far distant may favour its transference by a more legitimate process. It will be better so for all parties—for Rome itself, for the Supreme Pontiff, for France, for Italy. It is an end which must come, and come soon. Patience! and it will come of itself, quietly and peacefully.

THE VOLUNTEER BALL AT THE AGRICULTURAL HALL.

The Grand National Volunteer Ball, as it was called, which took place, at the Agricultural Hall, Islington, on the night of Wednesday week, though not so numerously attended as its promoters had expected, was a splendid scene to behold. The decorations were quite as gorgeous and brilliant as on the occasion of the ball given to the Belgian volunteers and the Prince of Wales, in July. The dais, of which an Illustration is given on our front page, was appropriated to the reception of the Lord Mayor and Sheriffs, and the seats on each side were occupied by ladies and gentlemen. In the orchestra were 150 musicians, under the direction of Mr. D. Godfrey, and on each side of it had been reared lofty banks of flowers and shrubs. The doors of the hall were opened at eight o'clock, but it was not until some time afterwards that the room was filled. At first the arrivals were few and far between; but by-and-by ladies in rich dresses and volunteers in their uniforms dropped in by twos and threes and spread themselves over the floor. Dancing began about ten o'clock, with a spirit which was maintained throughout the evening. After it had continued about an hour, it was suspended for a short time in order that due honour might be paid to the Lord Mayor and the civic authorities on their arrival. His Lordship, who was accompanied by Lady Gabriel and Miss Gabriel, Alderman and Sheriff Sir S. H. Waterlow and Lady Waterlow, Mr. Under-Sheriff Crossley, Miss Steddall, Miss A. Waterlow, Miss Lutwiche, Miss Law, Mr. P. Waterlow, and Mr. C. Evans, was saluted upon his entrance by a guard of honour, furnished by the 29th Middlesex Volunteers. He was received by Captain Defries, Hon. Artillery Company, chairman; Captain Williams, vice-chairman; Lieut. Green, the honorary secretary; and the other members of the ball committee, who conducted him to the dais. Among those who received the civic party were Major-General Bird; Colonel Cruikshank, of the Havelock Rifles; Colonel Wilkinson, and Messrs. Charles White, J. Pilcher, and J. Woodhouse. As the civic party entered the band played the march from the "Prophète." The Lord Mayor and his friends remained seated for only a short time, after which they descended into the hall, and a quadrille was formed, in which they took part.

About one o'clock supper was served. The Lord Mayor supped in the room occupied on the last occasion by the Prince of Wales. Mr. Defries took the chair at the head of the principal table; and after supper the healths of the Queen, the Prince and Princess of Wales, and the rest of the Royal Family; the Army, Navy, and Volunteers; and of the Lord Mayor and Corporation of the City of London, were proposed and duly honoured. After supper the dancing was resumed, and continued with spirit until a late hour.

FOREIGN AND COLONIAL INTELLIGENCE.

FRANCE.

(From our own Correspondent.)

Paris, Thursday, Oct. 3.

The release of Garibaldi, and whether this were or were not effected on conditions; General Prim's explanations and justification of himself from the charge of having left his co-conspirators in Spain in the lurch; and General Miguel Lopez's letter to the French journals emphatically denying that he betrayed Maximilian and attempting to explain his conduct at Queretaro, have formed the topics of particular interest during the past week for Parisians to talk about and journalists to comment upon. Although reports are still abroad of considerable deficiencies in the harvest, the price of bread has fallen within the last day or two, and is now down to the franc the 4½lb. loaf. This is high enough, you will think in England; but over here we are accustomed to buy our bread, our meat, and our fish at prices that would drive a careful London housekeeper crazy; but we have profited by the example set us by the eels, and, being thoroughly used to high prices, don't complain.

The Emperor and Empress make continual excursions in the neighbourhood of Biarritz, and Imperial life there pursues its accustomed round. The Ministers, too, are roaming about the provinces making tours of inspection and picking up stray waifs of popularity. Occasionally they are summoned to the presence of the Emperor, whereupon Ministerial modifications are forthwith talked of, as though they were positive certainties. The French press, both newspaper and pamphleteering, are again broaching the subject of war, which some of them have the boldness to demand, not next year, nor even next month, but at this very instant. Serious people, although they believe war with Prussia to be inevitable sooner or later, do not like this constant revival of the topic, in season and out of season, and at a time, too, when war would be most unpopular with the great mass of the French nation.

Some fanatics are again petitioning the Emperor to allow the palace and park which now occupy the Champ de Mars to remain *en permanence*. There is no chance whatever of their destruction being delayed a single day beyond the time originally fixed upon. No doubt owners of property in the neighbourhood, who have benefited largely by the Exhibition, are at the bottom of this movement. The popularity of the Exhibition is almost as great as ever, the daily average of visitors generally ranging from 30,000 to 40,000, and yet Paris is literally empty of Parisians. At the races at Longchamps, on Sunday last, when the Grand Criterium and Omnium Stakes were run for, there was but a moderate assemblage, and of the few ladies who occupied places in the grand stand nearly all were English.

Dr. Veron, author of the well-known "Mémoires d'un Bourgeois de Paris" and editor of the *Constitutionnel* at the time Eugène Sue's "Juif Errant" was published as the feuilleton of that journal—which it had the effect, by-the-way, of raising from a circulation of two or three thousand copies to upwards of ten times that number—died in Paris the other evening, at the age of sixty-nine. Veron was director of the Opera under the Government of July, and a supporter of the present Emperor on the fall of that monarchy. He was a clever conversationalist and one of the most distinguished *gourmets* in Paris, where alone the art of dining is carried out to perfection.

SPAIN.

A Royal decree has been issued at Madrid amnestying all persons, except officers, who took part in the late insurrection in Spain.

A manifesto has been put forward by General Prim to explain his conduct in the late insurrection. Prim says he could not enter Spain because the forces that were to have risen in the province of Gerona and to have fetched him from the French frontier failed in their engagement. He refers also to certain military men who have broken their word, but names nobody.

ITALY.

Garibaldi has been conveyed to Caprera; and the Government has officially announced that, as the General had expressed a desire to return to Caprera, and that intention conformed with the wishes of the Government, the Ministry at once agreed to his desire. Garibaldi himself, in a letter published at Florence, declares that he accepted the offer of liberty to proceed to Caprera without agreeing to any conditions. In another letter he advises his countrymen to proceed to the assistance of the Romans.

The province of Viterbo, in the Papal States, has been invaded by several bands of insurgents, who committed depredations.

Cardinal Antonelli has addressed a new note to the Powers of Europe, announcing the critical situation of the Holy See and demanding a general guarantee of its inviolability. The note declares, in the strongest terms, that the Pope will hold no communication with the usurpers of his dominions, and that he is ready to go into exile rather than submit to this indignity.

The French Chargé d'Affaires in Rome has exchanged with Cardinal Antonelli the ratification of the treaty of commerce concluded between the Papal Government and the French Cabinet.

PRUSSIA.

The Czarewitch, accompanied by his Consort, arrived at Berlin from Frankfort-on-the-Main, on Monday, and alighted at the Russian Embassy. The Crown Princess of Prussia went to Berlin to meet their Imperial Highnesses. The latter, after paying a visit to Potsdam, took their departure, viâ Copenhagen, for Russia. Count Bismarck, it is stated, has had a long interview with the Czarewitch.

In the North German Parliament the debate upon the Budget began on Monday, and several clauses have been adopted.

A Royal decree has been issued relative to the Provincial Estates Constitution of Schleswig and Holstein, which are henceforth to be united under the name of the province of Schleswig-Holstein. Prince Adalbert of Prussia and the Minister of Marine arrived at Kiel on Tuesday to be present at the hoisting of the North German federal flag.

King George of Hanover has, so a telegram from Berlin states, accepted the Prussian conditions for a financial arrangement.

The Assembly of Burghers at Hamburg have adopted, by a large majority, the motion of the Senate declaring the entry of Hamburg into the new North German Customs Union for the present inopportune, on the ground that that union requires modification. The old military contingent of the free town of Hamburg was formally disbanded on Monday, and the military defence of the town handed over to the Prussian troops. Lubeck has also received a permanent Prussian garrison.

THE UNITED STATES.

President Johnson and the members of the Cabinet, accompanied by the British, French, Italian, Spanish, Russian, and Mexican Ministers, were present, on the 17th ult., at the consecration of the National Soldiers' Cemetery, at Antietam, in Maryland.

General Sheridan has received ovations on his way to Washington.

The new Constitution has been adopted in Maryland by a democratic majority of nearly 20,000.

A negro judge presided, on the 17th ult., at the Recorder's Court of New Orleans. The cholera is still raging in that city.

COUNTRY NEWS.

A geological museum is about to be formed in the town of Sherborne, in Dorsetshire.

It is intended to form a new fashionable watering-place at Boldnor, at the south-west corner of the Isle of Wight.

On Wednesday the Lord Lieutenant of Ireland opened a new graving-dock and a tidal basin at Belfast.

The winter session of the Birmingham and Midland Institute was opened on Monday evening, on which occasion Mr. M. D. Hill, Q.C., the president, delivered an inaugural address.

An amateur concert, arranged by the Countess of Kinnoull, was given in the City Hall, Perth, yesterday week, in aid of the funds of the Perth County and City Infirmary. The proceeds amounted to £100.

The Exhibition of Art and Industry at Dundee—which had been open since Sept. 5, the first conversazione of the British Association—was formally closed on Monday evening. Lord Kinnaird, Sir John Ogilvy, M.P., and the Bishop of Brechin were among those present.

The birth of an heir to the Muckross estates, Killarney, has been celebrated with unusual festivities, in which the tenantry on the extensive estates of Herbert and the gentry of the neighbourhood shared. Upwards of 400 sat down to dinner on Thursday week.

Mr. Disraeli has accepted the proposal to confer upon him the freedom of the city of Edinburgh, on the occasion of his visit there. The Conservative banquet takes place on the 29th inst., under the presidency of Sir William Stirling Maxwell, M.P.

The executive committee of the National Exhibition of Works of Art, to be held at Leeds, in 1868, have been honoured by notifications that the Emperor of the French and the King of Holland will permit their names to be added to that of the Queen as patrons of the undertaking.

The annual meeting of the friends of the school-frigate Conway was held at Liverpool, on Tuesday—Mr. James Beesley in the chair. The report gave a most gratifying account of the progress of the ship, though, owing to the establishment of a similar vessel in the Thames, the number of pupils in 1867 had not been so great as in 1866.

Mr. Blissenden, chief officer of the coastguard at Roddens, county Down, states that it was he and his crew who, in an open boat, rescued the three men from the schooner yacht Tana, which was recently lost off that coast; and not the men of the Ballywalter life-boat, as was stated in his Journal of the 21st ult., on the authority of the *Northern Whig*.

A conference of Sunday School representatives from London, Liverpool, Manchester, Birmingham, Sheffield, Leeds, Halifax, Worcester, in all more than forty cities and towns in England, met in Birmingham on Tuesday and Wednesday to discuss the means of making Sunday school and Sunday school unions more powerful agents for the improvement of the social, moral, and religious condition of the people.

Sir Roundell Palmer, M.P., at the opening of the new buildings of Richmond Grammar School last week, delivered an address on education, in which he urged the importance of a careful study of the classics as well as of mathematics and foreign languages. He recommended, in fact, the maintenance of the old system of education in an extended form. He further addressed to the pupils some advice proper to the local circumstances of their school.

A finely laid out public park, originated by a legacy of £200 by the late Mr. Garden Mitchell, Edinburgh, to the city of Brechin, with a contribution of £100 from the Earl of Dalhousie, and a grant of eight acres of the Caldhame fens, and aided, too, by general subscriptions to the amount of above £1200, was opened at Brechin, by the Earl of Dalhousie, last Saturday afternoon. The day was fine, and was observed in the town as a general holiday. A procession of upwards of 2000 persons, including trades, factory operatives, Masonic, and other bodies, paraded the principal streets, and afterwards met at the grand stand in the park, where there was a large assemblage of gentry of the town and district.

A large co-operative store was opened at Rochdale on Saturday last. The building is 66 ft. high, and the frontage is built of stone. There are three shops on the ground floor, two of them of equal size, containing each 200 square yards, and they are to be used as grocery and drapery departments. The third, 85 square yards, is to be a shoeshop. The cellars are to serve as work-rooms for shoemakers and cloggers, and for warehousing. A drapery show-room, a grocery storage-room, and offices occupy the second story. A news-room, in size 170 square yards; a library-room, 150 square yards; two committee-rooms, and a waiting-room take up the third story. On the fourth is a large room, capable of seating 1500 persons, which is intended for public meetings and entertainments. The total cost of the building is over £10,000. The opening was celebrated by a tea in the building itself to 2000 people. This was followed by a meeting in the theatre, at which the Mayor presided. Mr. T. Hughes, M.P., delivered an address of considerable length, congratulating his hearers on the success the co-operative principle had secured in the locality, as manifested by the magnificent building that day opened.

"NOTHING IN THE PAPERS."

If I chronicle the important fact that I have been taking a holiday, it is only in connection with something else equally important that I do so. Wandering beyond railways, and in districts where regular perusal of any newspaper is by no means one of the recognised duties of life, I have managed to miss all journals containing the text of Count Bismarck's circular. As Neptune, I think, was discovered, not directly, but by inference, from the fact that some great body was causing disturbance which had to be accounted for, there was no difficulty in believing, from articles in the French and English papers, that something very emphatic had been said by the Prussian Minister. I met a good many tourists, chiefly educated persons, who carried Murray, and used elegant expressions anent the scenery amid which we were straying. To several persons of the masculine sex I addressed the inquiry whether they had seen Bismarck's circular—not that I particularly wanted to know, but one gets tired of comparing routes and telling down superlatives of delight against a fellow-traveller, as the Blind Beggar of Bethnal-green told down his gold coins against those of the gentleman. Three or four acquaintances said that they had seen it, and I asked what it was about. One said "Oh! I don't know; nothing particular—just like all those diplomatic papers, don't you know?" Another said, "Well, it appeared to me to be about as near a declaration of war as possible; and I don't see how war can be avoided after such an avowal as Bismarck's." A third said that it was a Jesuitical kind of document, and that it was meant to be read by the light of future events.—[N.B. I immediately conceived a great reverence for this profound and subtle commentator.] A fourth told me that it was a menace that if France did not immediately cease from arming, Germany would invade her. I was obliged to go on admiring the scenery, and at intervals endeavouring to harmonise these accounts. Having got back to town, and having discovered the document in question, I do not like to write down my opinion as to whether any one of the gentlemen above referred to had read the circular at all, any more than I had. But I impute no moral blame to any of them—or at least, I am quite willing to share whatever may attach—firstly, because one has no right to talk foreign politics to people who are enjoying themselves; secondly, because a well-informed man is bound not to be ignorant of anything that has happened; and, thirdly, because when I, in my turn, was questioned about the Bismarck circular, I, with the aid of the above explanations, gave information which was exactly of the same valuable character as that which I extorted.

How do my friends the tourists like the hotel charges this year? I have, as above mentioned, been out of the way of regular reading, but I have seen a good many newspapers, and I do not observe that any raging travellers have cited hotel-keepers before the bar of public opinion to answer for exactions on the holiday-maker. It is not my present purpose to lodge any complaints, and, indeed, I have had small cause. But there is one constant item in the hotel bill which keeps the word of promise to the eye and breaks it to the purse. This is the charge for "attendance." When this was first introduced it was considered, and rightly, an improvement on the old system. There was no greater bore than the sitting, pencil in hand, before the greedy waiter, and meditating on what figures you should add to your bill, which, moreover, used to be discreetly kept back till the very last moment, when the guard was blowing his horn, and that burly bagman was invading the front place which you had intended to have, so that you dashed down a great deal too much in order to get away. The regular charge saved all this discomposure. But we have now come to a state of things which is eminently unsatisfactory, at least to the traveller. Attendance is charged; but if you do not also "tip" waiter and chambermaiden personally, they look at you in a very unkind way, distressing to the gentle mind; and if your wife have left a handkerchief, or you a walking-stick, you may be quite sure that no smiling damsel will run after you with one, no prompt garçon with the other. As for the porter, he makes his demand as a matter of course, and one does not grudge it, for he is the only one who has done any hard work, or work for which you care to pay extra. I was at an hotel last year, and the house is in the Royal county, where, on my pointing out to the lingering waiter (who had only brought lunch) that attendance was charged, he said, with an abject stolidity, "We get none of it, Sir." And to my inquiry whether he thought that I ought to pay twice, he made exactly the same reply, rightly considering that I had no title to inquire into his private thoughts. I think I like this better than the sulk and scowl. Of course I shall be told that the landlord knows nothing of this, and that servants have no right to expect more than is charged for them, which answer, of course, is false, frivolous, and impertinent in the presence of facts. I think I will add that this paragraph concerns men only. I do not believe that the firmer minded half of society would add a farthing to the regular charge in the bill or care in the least whether servants looked cross or pleased; nay, a servant manifesting displeasure when a lady paid the charge would, probably, hear something very distinct and not at all agreeable. But I speak for the helpless creature called man, especially Englishman or American, who is asserted by his females to like being cheated.

It may be thought that a Londoner—or "cockney" (as our friends in Scotland think it witty and severe to write)—has no business with the Sunday (or "Sabbath," as our friends in Scotland think it accurate and pious to write) letter-delivery question. He can receive no letters, and he can send none away, except that, if he puts them into a pillar on Sunday night, they go thence at five or six in the following morning. But I submit that this Sunday delivery question, which seems to be a provincial one, has a London side to it. Surely no amount of local pressure should enforce a non-delivery, except in the case of the people who feel their minds unequal to the perusal of a letter on the day on which they have to listen to a sermon. Certainly letters ought to be forced on nobody, and those who prefer to take the chance of not hearing of a parent's or a child's illness until twenty-four hours' later than they might hear, ought to be indulged in that desire, though it makes one wonder whether they would refuse to listen to a messenger who came on Sunday with a story from the other end of the village; and, if not, how they would explain their apparent inconsistency, and prove that it is pen and ink, and not intent, that breaks the Sabbath. But inasmuch as there are thousands of persons who particularly wish for the London letter on Sunday morning, in order that the answer may be received in London on Monday, I submit that London has a right to be heard in the matter; and I trust that his Grace the Postmaster will not allow the agitation which is being renewed in certain quarters to have any effect with him.

If there is nothing in the London papers just now, there is a good deal in some of the country ones, of which I have seen a good many during the last month, and, let me hope, to my improvement. Something that I am going to mention, however, is not so much to my own advantage as to that of any of my readers who may also be members of the House of Lords. I came upon a leading article the other day which seemed to me of an unusually solemn kind. If I do not name the journal in which I read it, my reason is that I am not so certain as one ought to be in such a case whether the title were the *Somewhere Daily This* or the *Somewhere Daily That*, and a mistake might cause annoyance. But the article stated that Mr. Disraeli, having destroyed the House of Commons, was now about to do his best to destroy the House of Peers. And his reason for this reprehensible conduct was the recollection that in old days the ancestors of the present aristocracy had behaved with great cruelty to the race from which Mr. Disraeli is descended, and that he was now bent upon taking his revenge. I confess that this puts in a new light the motives of a gentleman of whose literary brilliancy and political genius I have spoken with a candid admiration, and I fear that until explanations are offered I must reluctantly withhold any further tribute to the ability of the Chancellor of the Exchequer. Revenge, as Lord Lytton has well said in "Alice," is so foolish.

MEMBERS OUT OF PARLIAMENT.

Thick as phessants at a battue, to use a perhaps forced but seasonable simile, have been the prelections of Parliamentary gentlemen roving among their constituents. Picking at pleasure being thus quite easy, the first choice may be made at Buckingham, where it would seem that the existing members were in a peculiar position. As this borough was included in the amputating schedule of that Reform Act which Mr. Disraeli would persist in declaring to have not the slightest taint of disfranchisement in it, and loses one of its members, the recent appearance of Sir Harry Verney and Mr. Hubbard before the electors may well be taken to be something in the nature of a competitive examination. Though neither of them in so many words proclaimed that he was the man who was best fitted to bear the whole weight of representation of a town which they assert to be increasing in importance and population, yet both seemed to be upon their mettle, and indirectly to ask a judgment on their respective qualifications. What the electors think, one cannot say; but an impartial person—that is, one who does not think that there is a pin to chose between them—might perhaps give the palm to Sir Harry Verney on this occasion. A soldier, and the son of a soldier, Sir Harry has nothing of the stern military manner about him, but is a delicate talker, delivering soft nothings in lackadaisical accents. On his Buckingham platform, however, he spoke brave words, and, certainly, very taking words to the tenant-farmer ear, for he asserted roundly, first that they wanted capital, to which there was a vigorous and unanimous assent; and, secondly, that, in the present dearth of investments, that plethora of money of which we hear so much might be reduced by turning some of it into the outstretched hands of the cultivators of the soil. Beyond this, he made the very practical suggestion that his colleague, Mr. Hubbard, who is, or claims to be, a finance-monger of the first order, should put his notion into action, and set an example which capitalists might be induced to follow. With a caution so marked as to argue a foregone conclusion in his mind, Mr. Hubbard took no notice of this special idea; but it may well be conjectured that he did not actually overlook it. Possibly, in considering the comparative chances of his re-election for Buckingham in solitary glory, he may have thought that his being a merchant prince, and a director of the Bank of England, might not be without its effect on a constituency to which it had been hinted that in order to become perfectly prosperous they had only to borrow a great deal of money.

Looking to the position as a private-business member which Colonel Wilson Patten holds in the House of Commons, on the face of it, it is just doubtful whether his services to the country will not be rather diminished than enlarged by his acceptance of office. It is true that the chancellorship of the Duchy of Lancaster, especially when the holder of the place is out of the Cabinet, is not supposed to imply very killing work; and so perhaps Colonel Patten may still be able to devote nearly as much of his time to the pushing along of the sub-business of the House, with which for so many years he has been identified. It was but right that the constituents of a gentleman who has the faculty—unaided by art, in the depreciatory sense of that word—to conciliate the goodwill of everyone with whom he comes in contact should hold high festival in his honour and recognise his claim to promotion in the State. Such a foregathering is exceptional, and, while it deserves mention, needs no comment.

In Parliament the descendants of Peel will always have a standpoint, factitious even though it be. In a certain lugubrious way, Mr. Frederick of that name was a success—if getting office early and holding it with tolerable tenacity be taken as success; while Sir Robert the Second is a "mighty man," and commands the ear of the House, as might be expected of an orator who has with singular felicity blended into one the separate styles of Colonel Sibthorp and Mr. Ferrand. The world generally may not know that a third scion of that family often essays to woo the favour of the House, which body, somehow, is rather neglectful of the palpable efforts to please of a speaker who has neither the grave solidity of Mr. Frederick nor the bluff vivacity of Sir Robert. A recent dissertation of Mr. Arthur Peel to his constituents at Warwick may be said to be compounded of negatives. A member who puts in the foreground his work in Committees during a Session may thus establish a merit; but, in the estimation of an unthinking public, which believes that speech-making is legislation, it may seem to imply a necessity for making the best of a Parliamentary case. To be sure, Mr. Peel did specify something that he had done in the numerous Committees in which he sat, for he had aided in enabling the London, Chatham, and Dover Railway Company to raise more money—no small feat. He believed that the Committee on the malt tax had enabled, or would enable, the poor man to have an improved beer—which ought to be a popular result. Besides, the hon. gentleman having put his name on the back of a bill relating to education of which he knew nothing, was himself compelled in the event to vote against it. But his greatest claim to sympathy seems to be that he has been singled out by a portion of the metropolitan press for a series of attacks because, as it is asserted, he is favourable to a "violent and compulsory education." As he has repudiated all notion of violence on the matter, let it be hoped that the "attacks" may cease, although, to be sure, they have not made much noise, or attracted much, if any, attention.

As a rule, Irish members are not much given to extra-Parliamentary utterances. There are tolerably obvious reasons for this reticence; and haply the representatives of the sister kingdom are relieved from one of the penalties of their calling. The appearance of Sir Joseph M'Kenna at what may be almost designated as a domestic gathering at Youghal, might well be made the subject of special remark, only that the difficulty is that very special remark. There is a solidity, a compactness, an air of business-like prosperity about this honourable gentleman, which takes him out of the category of Irish members. When "his mouth he opes" you do not expect, as in the case of his legislative countrymen, that there should "forthwith issue tropes," but rather you anticipate information as to how the National Debt is to be diminished, or perhaps increased; and as you listen you seem to feel that each word he utters, if properly estimated, must be worth a thousand pounds. One calls to mind a lecture of several hours' length which Sir Joseph delivered to two or three members during last Session, which had for its text, one believes, the taxation of Ireland, and which the few representatives of mankind present were fain to accept as a vast accumulation of economic wisdom. It may, therefore, easily be accepted that the member for Youghal's review of himself during the late Session was eminently satisfactory to those who by a figure of speech are called his constituents; and not the worst thing that any one could wish himself would be that he was one of them. It is observed that Sir Joseph has unreservedly gone in for the subvention of Irish railways by Government, and that really seems to be the great question for Ireland after all.

Without too curiously inquiring how "got he there," let it be recorded that Mr. Walpole has been pronouncing on education at Swindon. Those heartless jesters who in the last spring never spared the perplexed Home Secretary one jibe or one jeer little knew the change that care and anxiety were bringing upon that worthy but somewhat fatuous administrator. Until then nothing could be more complacent—may it be permitted to say, more smug?—than Mr. Walpole's countenance. It was round, with scarce a latent angle to be discovered; and on his lips there always played that gentle smile which ever accompanies the consciousness of unimpeachable respectability. But, when the Session set, what a falling off was there! The face was lengthened, the visage wan, the cheek furrowed, the smile had vanished, the lips were compressed, and the hair, which, though thin, used to assert itself with a certain liveliness of appearance, was lank and depressed. In short, it was the shadow of that Mr. Walpole who was wont to play with such effect the *vir pietate gravis* over the House. Indeed, he seems to have passed over that Shakspearean stage in which "wise saws" prevail, and to have verged towards the next, which it is not necessary too particularly to specify. Perhaps the best tribute which can here be paid to the address the delivery of which has caused his name to be inscribed in this chronicle would be to give a specimen of his style; and, as orators are always supposed to put out their strength in their perorations, here are his last words:—"I say that we are all desirous that this great community shall be governed by a well-instructed and not an ill-instructed, by a well-educated and not an ill-educated, by a happy, a contented, a virtuous, and an industrious people." In the earlier days of Mr. Walpole's Parliamentary career Mr. Roebuck used to be prone to catch up his last words and sarcastically repeat them in a tone which was intended to suggest that they were only sound, and signified nothing. But then Mr. Roebuck is always so severe.

In one, and that a physical sense, Mr. Ward Hunt, Financial Secretary to the Treasury, is a great man, and undoubtedly he possesses a quality which generally goes towards the making up of a great man in another sense; for a more imperturbable demeanour was never developed by an official or a member. He says and does everything with a superb *aplomb*; and always when he has those difficulties to meet to which an ostensibly subordinate member of the Government is subject; when he has to justify mistakes, and to draw off the scent from something that administrative reformers are running after as a job, he goes in with an ease and placidity which (the illustration must be forgiven) a prizefighter would envy, and, after a good wrestle with his adversaries, comes out of the conflict without having turned a hair—and his capillary developments are considerable. Of course, all this, which stands him in so much stead in the House, enables him to meet his constituents with all facility and self-complacency. A speech of his the other day in Northamptonshire was a fair specimen of his way; and one cannot but admire the coolness with which he, one of the guardians of the national money-box, and who is supposed to be always calculating financial eventualities, stated that he had not the least idea what the Abyssinian expedition would cost the country.

MUSIC.

An operatic company are giving performances in Dublin with remarkable success. The principal performers are Mdlle. Titiens, Mdlle. Sinico, Mdme. Trebelli, Signors Bettini, Gassier, Foli, Bossi, Casaboni, Hohler, and Santley. It appears from the Dublin papers that "The Huguenots," in particular, made an extraordinary sensation.

The few eminent performers who remain in England during the present dead season are employed chiefly in singing and playing at the various watering-places. We observe, in particular, concerts at Brighton, Margate, Scarborough, Herne Bay, and other places, where much good music has been given, with profit to the givers and benefit to the taste of the provincial public.

Rossini's musical parties on Saturday evenings are attended by all who have the means of enjoying so great a privilege. A few weeks ago the great maestro's saloons were filled with a crowd of amateurs, eager to hear some new pieces for the piano, newly composed by him. They were played by M. Albert Lavignac, a young and very talented pianist, and were vehemently applauded of course. Among the company present were the distinguished dilettanti Prince Belgioso, M. and Mdme. Goldberg, and the celebrated Ferdinand Hiller, of Cologne.

Hector Berlios has been invited by the Grand Duchess Helena of Russia to undertake the direction of the concerts of the Conservatoire at St. Petersburg—an invitation which he has accepted.

THE THEATRES.

The reopening of the London theatres progresses, but is undistinguished by the production of new pieces. The Princess's on Monday started the regular season, with the reappearance of Mr. and Mrs. Boucicault, in their favourite drama of "Arrah na Pogue." A crowded audience greeted with acclamations the reproduction of a play which from its commencement was eminently successful, and has been triumphantly acted on the Paris, American, and Australian stages at various times since. The subject of this drama is felicitous in the extreme, and the characters, one and all, form grateful parts for the performers engaged in their representation. In structure, also, the author has been singularly happy; while the dialogue is throughout dramatic and free from surplusage. Verbosity is not among Mr. Boucicault's faults; he compresses the talk into the smallest compass without sacrificing to conciseness either the poetry or the pathos of the sentiment. At this theatre the play has always been assisted with appropriate and beautiful scenery, while the costumes and arrangements of the stage have been admirable. The acting of the piece this season is not quite so complete as formerly. Mr. Brougham no longer plays The O'Grady, and Mr. Vining lacks for it certain accomplishments which his general merits are not sufficient to substitute. But Shaun the Post and Arrah Meelish shine in their original lustre, being still represented by the author and his highly talented wife. Miss Hughes, as Fanny Power, though not quite equal to Miss Oliver, is nevertheless good; and Mr. Dominick Murray still continues as the incomparable and unique representative of Mike Feeny, the process-server. The other characters are adequately filled by Mr. W. D. Gresham, Mr. Maclean, Mr. J. G. Shore, and Mr. G. F. Neville. The drama promises to retain possession of the stage for many weeks.

The Strand opened on Saturday, with Mr. Hay's farce of "Our Domestics" and "The Latest Edition of Kenilworth," aided, by way of conclusion, with the old favourite, "Deaf as a Post." In the representation of these pieces the company is remarkably strong, and each member of it is suitably fitted with a part. The talent and ability displayed are also well harmonised; and at the conclusion of the evening's entertainment we could not help feeling that great judgment has been exercised both in the selection of pieces and of the persons who are the representatives of the numerous characters assembled in the entire performance.

The Prince of Wales's also opened on Saturday. Mr. T. W. Robertson's comedy of "Caste" was performed, with its original representatives, except one, Miss Larkin being substituted by Mrs. Leigh Murray in the part of the Marquise de Saint-Maur. Mrs. Murray is fully adequate to the impersonation.

Mr. J. Arnold Cave took possession of the Victoria on Saturday, and produced a new piece, by Mr. Nelson Lee, called, "The Sin of a Life; or, Remorse and Atonement." Three performers distinguish themselves favourably in this drama—Mr. Nanton, Miss Neville, and Mr. Fitz-Davis, the last of whom made his first appearance in London. There were other first appearances, all deserving of favourable notice. The performances concluded with the comedy of "Geralda; or, Who Is My Husband?" This theatre, thus opened by an experienced manager, is likely to assume a rank not hitherto asserted by its conductors. In the midst of a populous neighbourhood, it ought to take a commanding position.

Mr. Charles Dickens has decided to visit America for the purpose of giving a series of readings.

Intelligence received from Havannah announces the death of General Manzano, Captain-General of Cuba. He died of yellow fever.

The congress of German naturalists, sitting at Frankfort, has resolved to hold its next session, from Sept. 18 to Sept. 24, 1868, at Dresden.

The *Gazette* of Tuesday contains the Speaker's notice for an election for Bradford of a member in place of the late Mr. Wickham. The Liberals have selected for their candidate Mr. Edward Miall, of the *Nonconformist*. It is thought that the contest will be severe.

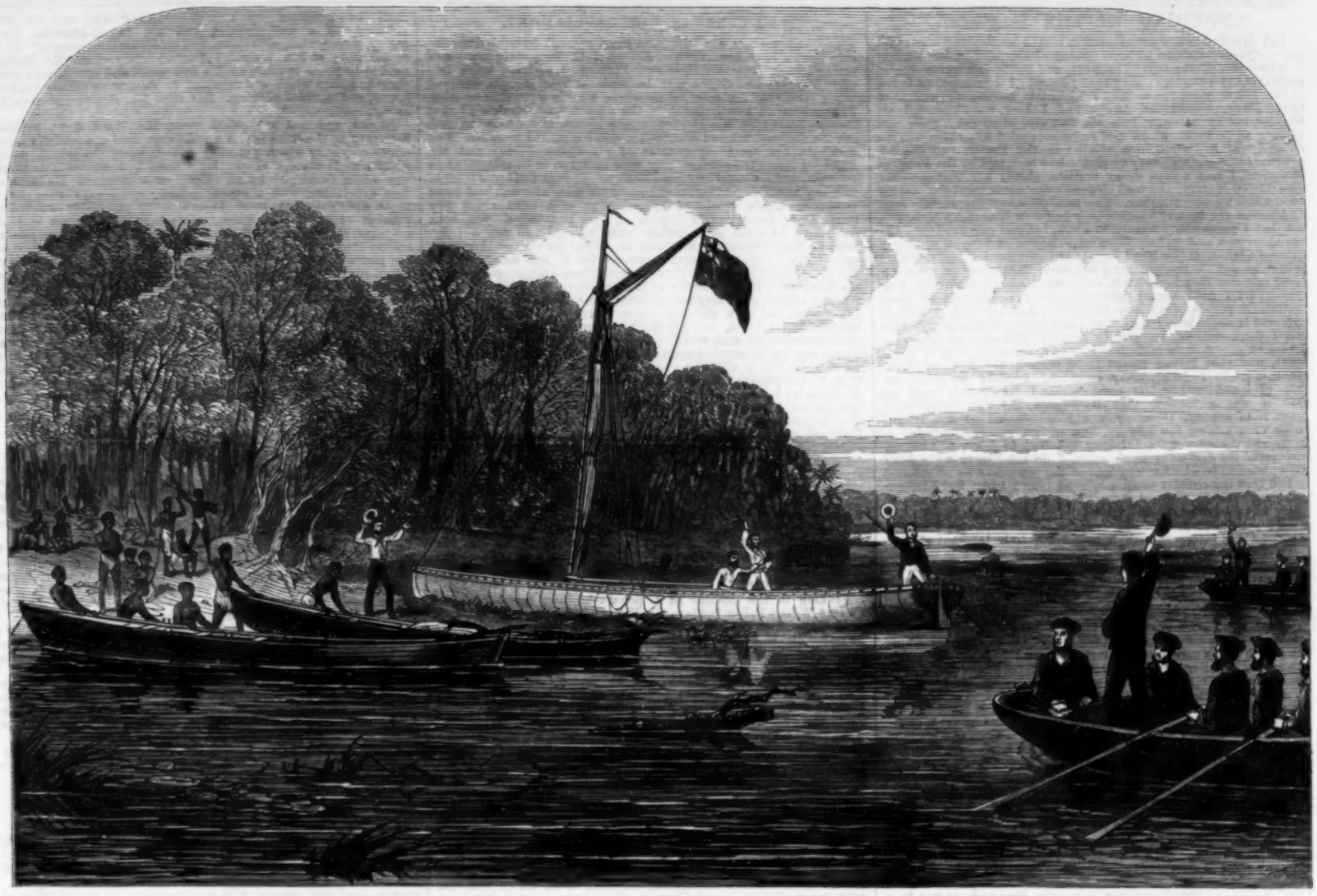
According to a telegraphic despatch received at Paris, the Brasilians have recommenced active operations against the Paraguayans, and the allied fleet has bombarded the forts of Humaita and Curupaity, but with what result is not stated.

The Duke of Cambridge arrived at Knowsley on Wednesday evening, on a visit to Lord Derby. On Thursday his Royal Highness was present at the opening of the new Townhall at Preston, and on Saturday (to-day) he will review the volunteers of the county at Sefton Park.

By means of the extension of telegraphic communication from the United States to Cuba a message can now be received in London from Jamaica in one day, from San Domingo in two days, from St. Thomas in five days, from Barbadoes in seven days, and from Demerara in ten days.

The new postal convention between England and the United States, so far as regards printed papers of all kinds and patterns and samples of merchandise, has come into operation. The part of the convention which relates to letters reducing the charge to 6d. per ½oz. will not take effect till Jan. 1.

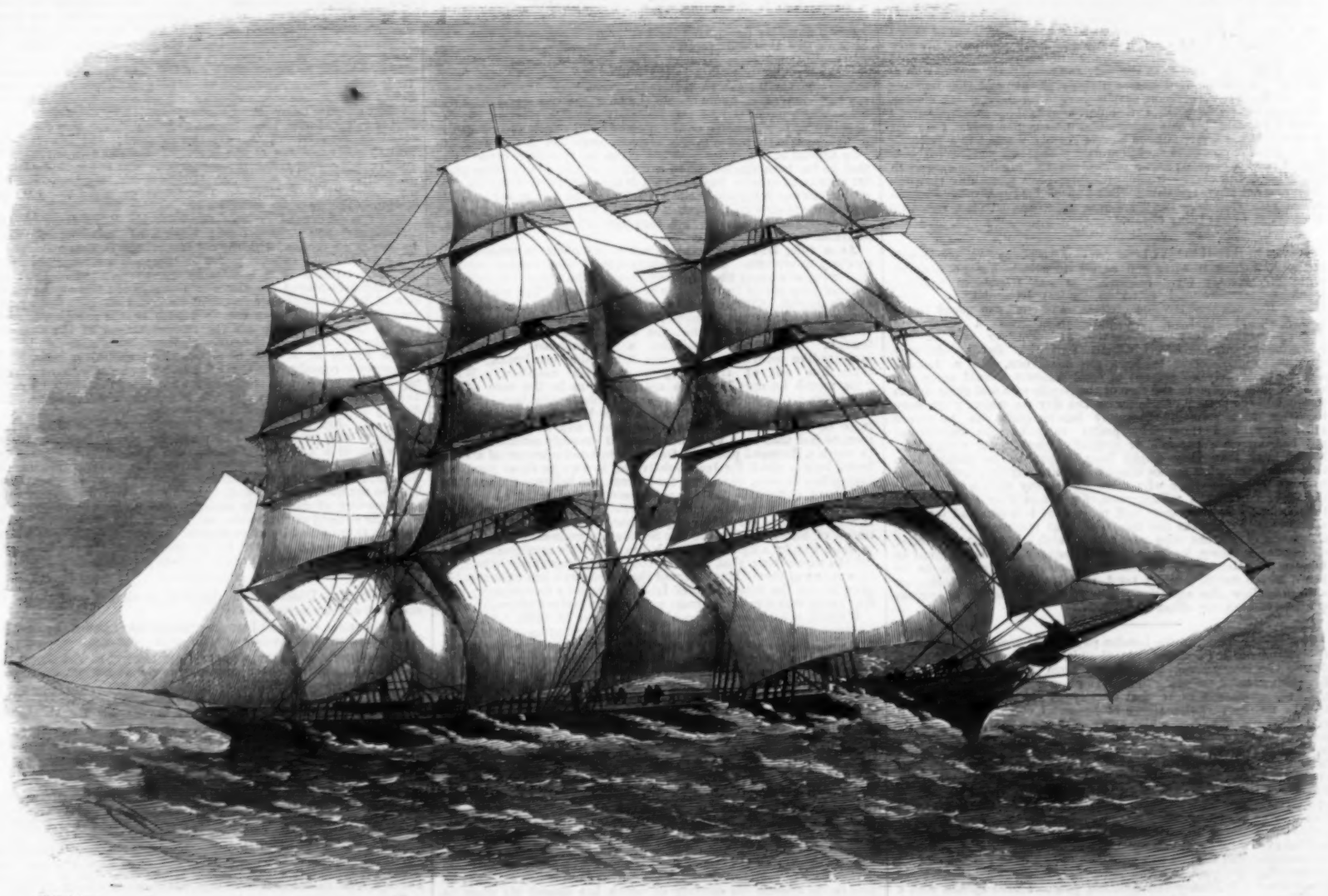
DEFECTIVE ORIGINAL



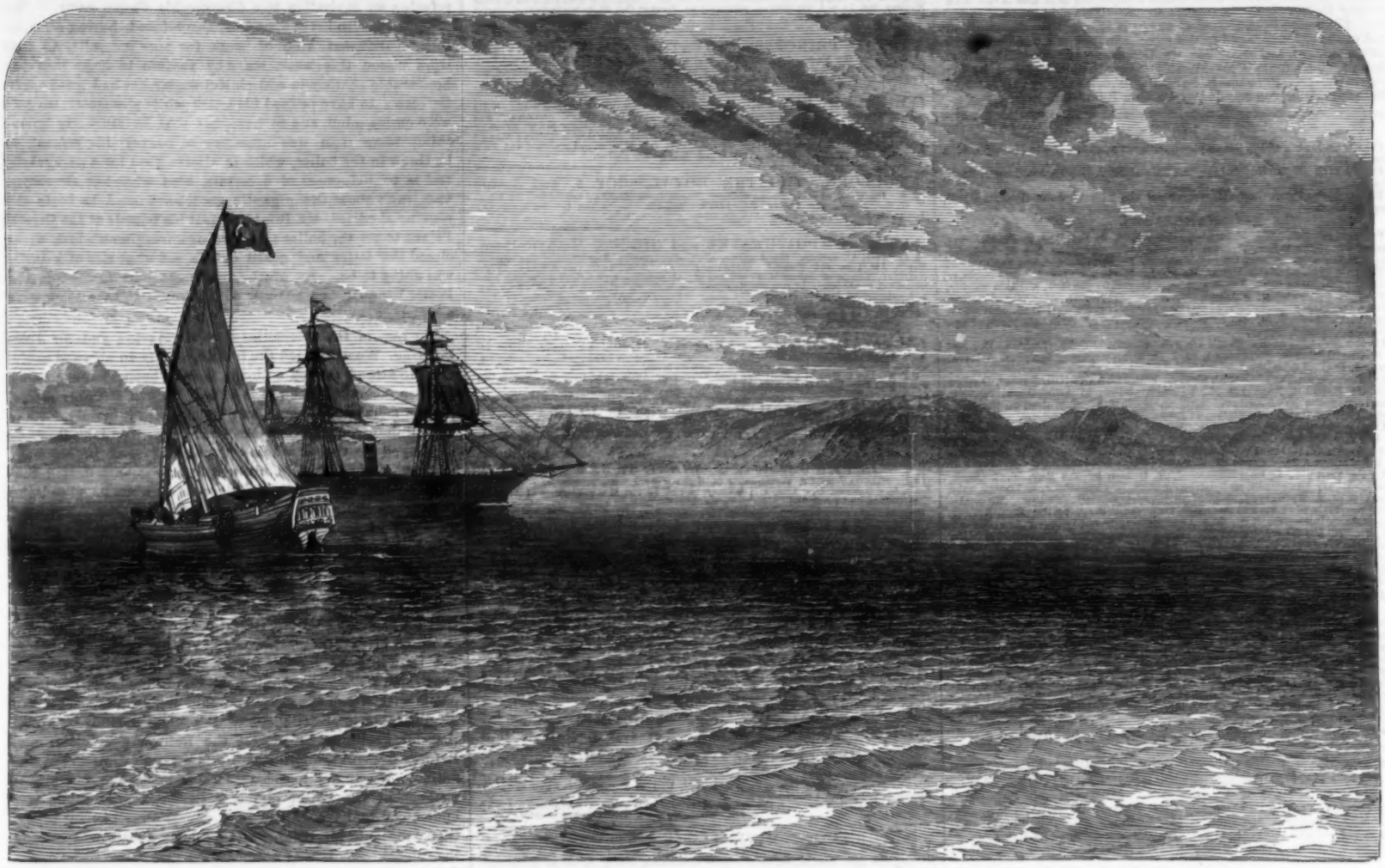
STARTING OF THE LIVINGSTONE SEARCHING EXPEDITION ON THE ZAMBESI.—SEE PAGE 368.

THE OCEAN RACE OF TEA-SHIPS FROM CHINA.

ALTHOUGH the premium formerly awarded to the first ship coming into the Thames with a cargo of the new tea of the year from China has been withdrawn in 1867 on account of the state of the tea market and freight market, the ocean race on this occasion has excited a good deal of interest. The first ship which arrived, on the 14th ult., entering the London Docks between two and three o'clock in the afternoon of that day, was the Taeping, owned by Messrs. Rodgers and Co., of Glasgow, a vessel built at Greenock, which won the prize last year. Her late commander, Captain Mackinnon, having died on his voyage out, she was commanded by Captain



THE ARIEL, WINNER OF THE OCEAN-RACE FROM CHINA



THE COAST OF ABYSSINIA FROM THE RED SEA.—SEE PAGE 369.

Dowdy. But the Ariel, another Clyde-built ship belonging to Glasgow, which arrived on the 23rd at seven in the morning, less than nine days after the Taeping, claims to have beaten her in the race, as respects the time occupied in the voyage; the Taeping having sailed from Foo-Chow-Foo on June 4, and the Ariel on the 13th. We give an Illustration of the Ariel, which belongs to Messrs. Phillips, of Royal Exchange Buildings, and was commanded by Captain Keary. In the race of last year she was only half an hour behind the Taeping. Both ships were built at Greenock in the same year. Lloyd's Register of Shipping furnishes the following details respecting them:—They were both built on the composite principle—iron frames and teak planking. The

INDIAN TROOPS FOR THE ABYSSINIAN EXPEDITION.—SEE PAGE 369.

Ariel is 853 tons register, 197 ft. 4 in. in length, 33 ft. 9 in. in breadth of beam, and 21 ft. depth of hold; classed A 1 for fourteen years. The Taeping is 767 tons register, 183 ft. 7 in. in length, 31 ft. in breadth of beam, and 19 ft. 9 in. in depth of hold, and also similarly classed. Another arrival from China completely put the Ariel and Taeping in the shade as regards speed. This ship was not in the race. She sailed from Shanghai on June 16, after the departure of most of the ships engaged in the race. She took what is termed the eastern passage, and arrived in the Downs on the morning of the 23rd ult. This route is considerably longer than that taken by the ships in the race. Her name is the Sir Lancelot, belonging to Greenock, 886 tons register, commanded by Captain Robinson.

BIRTHS.

On the 28th ult., at 53, Eaton-place, Belgrave-square, Lady Hartopp, of a daughter.

On the 27th ult., at Gadebridge, the wife of Sir Astley Paston Cooper, Bart., of a son.

On the 25th ult., at Grove House, Yeovil, the wife of John Hoskins Ryall, Esq., of a son.

MARRIAGES.

On the 24th ult., at St. Martin's-in-the-Fields, by the Rev. S. Flood Jones, Canon of Westminster, William Barton, only surviving son of R. Long, Esq., M.D., Arthurstown, county Wexford, to Elizabeth, eldest daughter of William Wilson, of White House, Rothbury, Northumberland. (No cards.)

On the 2nd inst., at St. James's Church, Dover, by the Rev. William Taylor, Rector of Swynnerton, Staffordshire, John Grey, Esq., of the Parklands, Gloucestershire, youngest son of the late Lieutenant-Colonel Grey, of Norton, near Stockton-on-Tees, to Elizabeth, daughter of John Marriott, Esq., Waterloo-crescent, Dover.

On the 26th ult., at St. Paul's Church, Charlton, John Graham, Esq., of 7, Shornhill-terrace, Sunderland, to Jean Sim, youngest daughter of Wm. Braund, Esq., of Charlton.

On the 26th ult., at the parish church, Walton-on-the-Hill, Surrey, George William Marshall, Esq., L.L.M., barrister-at-law, to Alice Ruth, younger daughter of the Rev. Ambrose William Hall, M.A., of Walton-on-the-Hill, and some time Rector of Debden, in Essex. No cards.

On the 28th ult., at St. Columb's Church, Moville, in the county of Donegal, by the Rev. Thomas Olphert, Rector of Lower Moville, Joseph Findlater, of London, youngest son of the late Captain John Findlater, of Liverpool, to Ellen Marion, daughter of W. J. Eames, Esq., Londonderry.

On the 28th ult., at Moretonhampstead, Devon, by the Rev. W. C. Clack, Charles Henry Langmead, of 6, Ulster-terrace, Regent's Park, to Louisa, only daughter of M. W. Harvey, Esq., of Moretonhampstead, solicitor. No cards.

On the 29th ult., at St. George's, Hanover-square, by the Rev. Arthur Druce, John P. Clover, Esq., M.A., barrister-at-law, to Esther Ann, second daughter of the late John Sparks, Esq., of Clifton Hall, Cumberland. No cards.

On the 19th ult., at the parish church, Bitterne, by the Rev. Frewen Moor, assisted by the Revs. Harrison and Shayler, Major James Michael, Madras Staff Corps, to Adelaide, only daughter of Oswald Grimston, Esq., of Moraham, Hants.

DEATHS.

On the 19th ult., at Cliffeton, Fermoy, Ellen, relict of the Rev. Richard Deane Freeman, late Rector of Ardnageehy, in the county of Cork. Her end was peace.

On the 18th ult., at his residence, 143, New Bond-street, Joseph Lewis Franklin, Esq., formerly of Naples, Italy. Deeply regretted.

On the 28th ult., at Hartsbourne Manor, Herts, the residence of her son-in-law, Joseph Sladen, Esq., Etheldred, relict of John Baker Sladen, Esq., of Ripple Court, Kent, daughter of the late Kingsman Baskett St. Barbe, Esq., in the 83rd year of her age.

*** *The charge for the insertion of Births, Marriages, and Deaths, is Five Shillings for each announcement.*

CALENDAR FOR THE WEEK ENDING OCTOBER 12.

SUNDAY, Oct. 6.—Sixteenth Sunday after Trinity. St. Faith, virgin and martyr. Death of Bernard, Comte de Lacepède, naturalist, 1825.

MONDAY, 7.—Battle of Lepanto (the Turkish fleet defeated by Don John of Austria), 1571. Death of Johann von Zimmermann, philosopher, author of the treatise on "Solitude," 1795.

TUESDAY, 8.—Battle of Andernach (Charles the Fat defeated by his nephews), 876. Chinese outrage on the British lorcha Arrow led to war, 1856.

WEDNESDAY, 9.—St. Dionysius, or Denis, Archbishop and martyr. Abolition of the order of Bishops in England by Parliament, 1646.

THURSDAY, 10.—St. Paulinus, Archbishop of York, confessor. *Edinburgh Review* first published, 1802. Queen Isabella of Spain born, 1830; married to her cousin, 1846. Oxford Term begins.

FRIDAY, 11.—Old Michaelmas Day. Death of Samuel Wesley, musician, 1837. Mantua surrendered to the Italians, 1866.

SATURDAY, 12.—Death of Robert Stephenson, railway engineer, 1859. Pekin captured by the English and French army, 1860.

TIMES OF HIGH WATER AT LONDON BRIDGE

FOR THE WEEK ENDING OCTOBER 12, 1867.

Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.	
M	A	M	A	M	A	M	A	M	A	M	A	M	A
h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
7 10	7 43	8 16	8 58	9 39	10 20	10 59	11 31	—	—	0 25	0 45	1 5	1 24

THE WEATHER.

RESULTS OF METEOROLOGICAL OBSERVATIONS AT THE KEW OBSERVATORY OF THE BRITISH ASSOCIATION.

Lat. 51° 28′ 6″ N.; Long. 0° 18′ 47″ W.; Height above Sea, 24 feet.

DAY.	DAILY MEANS OF				THERMOMETER.			WIND.		Rain in hours, read at 10 A.M. next morning.
	Barometer Corrected.	Temperature of the Air.	Dew Point.	Relative Humidity.	Amount of Cloud.	Minimum, read at 10 A.M.	Maximum, at 10 P.M.	General Direction.	Movement in 24 hours, read at 10 A.M. next morning.	
	Inches.	°	°		0-10	°	°		Miles.	In.
Sept. 25	30·455	51·1	44·9	·81	5	33·5	59·3	NNW. N.	..	0·600
26	30·435	51·2	..	..	4	38·9	61·9	..	..	·000
27	30·324	52·8	45·2	·77	7	46·6	60·6	W. WSW.	..	·900
28	30·226	55·6	48·0	·77	6	49·3	62·4	W. WSW.	..	·000
29	..	..	..	..	..	49·3	61·7	..	..	·068
30	30·065	52·4	49·7	·88	7	50·3	63·1	W. WNW.	..	·000
Oct. 1	30·421	50·2	37·0	·63	1	43·3	56·3	N. SW.	..	·000

The following are the readings of the meteorological instruments for the above days in order, at half-past nine a.m.:—

Barometer (in inches) corrected	30·455	30·469	30·370	30·237	30·206	30·078	30·435	
Temperature of Air	49·9°	50·9°	54·9°	57·9°	52·9°	50·8°	50·1°	
Temperature of Evaporation ..	46·1°	49·2°	50·3°	54·7°	54·7°	53·8°	43·9°	
Direction of Wind	NW.	..	W.	W.]	W.	W.	..	

THE REVENUE.

—	The YEAR ended Sept. 30, 1867.			QUARTER ended Sept. 30, 1867.		
	Net Revenue.	Increase.	Decrease.	Net Revenue.	Increase.	Decrease.
	£	£	£	£	£	£
Customs	22,492,000	871,000	..	5,802,000	..	39,000
Excise	20,334,000	79,000	..	4,330,000	..	220,000
Stamps	9,609,000	253,000	..	2,300,000	125,000	—
Taxes	3,525,000	103,000	..	272,000	29,000	—
Property Tax	5,695,000	100,000	..	648,000	15,000	—
Post Office ..	4,590,000	225,000	..	1,200,000	40,000	—
Crown Lands	332,000	10,000	..	72,000	1,000	—
Miscellaneous	2,893,471	..	630,671	719,740	..	232,358
Totals ..	69,470,471	1,641,000	630,671	14,913,740	210,000	492,358
		£1,010,329 Net Increase.			£282,358 Net Decrease.	

THEATRE ROYAL, DRURY LANE.—Sole Lessee and Manager, Mr. F. B. Chatterton.—On MONDAY, OCT. 7, and during the Week, her Majesty's servants will perform Shakspeare's Tragedy of KING JOHN—principal characters by Mr. Phelps, Mr. Barry Sullivan (his first appearance this season), Mr. Ryder, Mr. Edmund Phelps, Mr. W. M'Intyre, Mr. Barrett, Mr. James Johnstone, Master Percy Roselle, Mrs. Vandenhoff, Mrs. Herman Vezin. To conclude with Pocock's romantic Drama of THE MILLER AND HIS MEN, with the Original Music by the late Sir Henry Bishop. Characters by Messrs. Ryder, E. Phelps, Harcourt, Barrett, Rouse; Mdmes. Edith Stuart, Stafford. Scenic Department under the direction of Mr. William Beverley. Musical Director, Mr. J. H. Tully. Stage Manager, Mr. Edward Stirling. Doors open Half-past Six; commence at Seven. Box Office open from Ten till Five daily.

NEW SURREY THEATRE.—Monday, Sept. 30, and during the Week, at Eight, the Romantic Drama, NOBODY'S CHILD—Joe (Nobody's Child), Mr. Creswick. Preceded, at Seven, by the farce, A CURE FOR THE FIDGETS.

THEATRE ROYAL, HAYMARKET.—Last Week of Mrs. Scott-Siddons and Last Week of ROMEO AND JULIET. Last Five Nights of Mr. Buckstone in TO PARIS AND BACK FOR £5. SATURDAY, OCT. 12, BENEFIT and LAST NIGHT of MRS. SCOTT-SIDDONS.—ROMEO AND JULIET and KATHERINE AND PETRUCHIO—Petruchio, Mr. Howe; Katherine, Mrs. Scott-Siddons. Miss Amy Sedgwick will reappear for Twelve Nights in AN UNEQUAL MATCH, commencing Monday, Oct. 14, and Mr. Sothern positively on Monday, Oct. 28, in his famous character of LORD DUNDREARY.

ROYAL PRINCESS'S THEATRE.—On MONDAY, and during the Week, at a Quarter to Eight, ARRAH NA POGUE—Shaun the Post, Mr. Dion Boucicault; The O'Grady, Mr. Vining; Arrah Mealish, Mrs. Dion Boucicault. Preceded by POOR PILLICODDY; and followed by NO. 1 ROUND THE CORNER.

THEATRE ROYAL, ADELPHI.—Sole Proprietor and Manager, Mr. B. Webster. Directress, Mrs. Alfred Mellon.—MONDAY, and TUESDAY, THE IRISH TUTOR. Wednesday and rest of Week, MAN IS NOT PERFECT, NOR WOMAN NEITHER.—Mr. Belmore and Mrs. Alfred Mellon; MASKS and FACES.—Mr. Benjamin Webster, Miss H. Sims, and Mrs. Alfred Mellon; and THE SCHOOL FOR TIGERS.—Mr. G. Belmore and Mrs. Alfred Mellon.

HOLBORN THEATRE ROYAL.—OCT. 5, and during the Week, at Seven, T. W. William's Farce, DANDELION'S DODGES. At Eight, T. W. Robertson's new Drama, FOR LOVE. Box-office (open Ten till Five), and all Libraries.

ROYAL AMPHITHEATRE and CIRCUS, High Holborn. Novel Attractions. Great success of Charles Lauris's New Ballet, "The Fiend of Earth, Air, Fire, and Water." Startling Effects. SCENES in the ARENA, by the matchless Troupe of Equestrians; altogether universally acknowledged to be the most successful combination of remarkable equestrian feats, with singular acrobatic dexterity, and episodes of discreet drollery, for many years witnessed in the metropolis.—Vide "Daily Telegraph." Commence at Eight. Grand MORNING PERFORMANCE EVERY SATURDAY at 2.30. Carriages may be ordered for a Quarter to Five.

CRYSTAL PALACE.—AUTUMN RESORT.—Monday to Friday, One Shilling; Saturday, Concert and Afternoon Promenade, Half a Crown. Guinea Season Tickets, dating from Oct. 1, now on issue.

NOTE.—The troupe of twenty-five Beni-Zoug-Zoug Arabs have been re-engaged, and will appear from Monday to Thursday inclusive.

MR. and Mrs. GERMAN REED, with Mr. JOHN PARRY, will REAPPEAR on OCT. 14, in A DRAMA IN VENICE. To conclude with MERRYMAKING, by Mr. John Parry. ROYAL GALLERY OF ILLUSTRATION, 14, Regent-street. In preparation, a New Entertainment, by Shirley Brooks.

MR. LEVY'S BENEFIT CONCERT, ST. JAMES'S HALL, MONDAY NEXT, commencing at Eight o'Clock. Stalls, 10s. 6d.; Reserved Seats, 5s.; Balcony, 3s.; Area, 2s.; Gallery, 1s.; at all the Musicsellers', and Austin's Ticket-office, 28, Piccadilly.

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Manager, Mr. FREDERICK BURGESS.

THE BIRDS WILL COME AGAIN, by J. R. Thomas; "Who is It Lying Beneath the Broad Palm?" "I'll Meet Thee in the Lane," and "Little Maggie May," the most beautiful and successful ballads ever introduced by the CHRISTY MINSTRELS, will be Sung at the ST. JAMES'S HALL, Piccadilly, at Every Performance until further notice.

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It is nearly Three Years since the Christy Minstrels have given a Performance out of London.
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LECTURES on MINERALOGY and GEOLOGY, at KING'S COLLEGE, LONDON, are given on WEDNESDAY and FRIDAY MORNINGS, from Nine to Ten, by Professor TENNANT, F.G.S. Those on Mineralogy begin Friday, Oct. 4, and terminate at Christmas; fee, £3 3s. Those on Geology commence in January and continue till June. A shorter Course of Lectures on Mineralogy and Geology is delivered on Thursday Evenings, from Eight till Nine. These begin Oct. 10 and terminate at Easter; fee, £1 11s. 6d. Professor Tennant accompanies his Students to the Public Museums and to places of geological interest in the country.
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THE ILLUSTRATED LONDON NEWS.

LONDON: SATURDAY, OCTOBER 5, 1867.

WE should not have thought it necessary to make any further reference to such an affair as the Reform Fête of Monday last but that it is, in its way, a part of the history, if not of Reform, of the Reform agitation. The entire proceeding was the failure which might have been expected, and if the bosom of the "noble Beales" has any room for the ignoble sentiment of satisfaction at the disgrace of a rival, that personage must triumph at the complete *fiasco*. We cannot say that we have the least sympathy for those who have made themselves the laughing-stock of Reformers. They initiated a festivity with which they had no business; they impertinently invited men whom they had no right to address, and they have been snubbed; and their fête, in spite of the additional attractions of gymnastics and fireworks, was but half attended, and not a single notability was present. Scarcely more than half the number for whom preparations had been made attended the dinner.

The fête deserves no prettier word, but it should be mentioned that Mr. Gladstone, twice petitioned to grace the affair with his presence, decidedly refused, but in the kindness of his heart went out of his way to suggest that there was some justification for the meeting. This, to those who know the character of Mr. Gladstone's mind, makes it abundantly clear that at the first blush it appeared to him that the affair was uncalled for, and perhaps those whom he addressed may not be altogether thankful to him for helping them to an excuse, especially as he instantly followed up his courtesy by reminding them that the class about to be admitted to power had its duties to think of as well as its privileges. This, indeed, is the one note which every statesman is called upon to sound, in season and out of season; and it is well that the signal should be given by Mr. Gladstone, to whom even the Potter and Beales party affect to look with respect. It is not every man who has the gift of enforcing a moral lesson while refusing an invitation to a disagreeable dinner-party. Mr. Bright was also invited, and he also refused, having set himself "a different kind of work for this recess." As that work closed this week, we may venture to hope that the honourable gentleman and skilful angler has had good sport. He seems to have penned his letter while pleasanter matters were on his mind, and to have felt that he must say something more than was necessary to convey his refusal, so he threw in the ballot, which is always good for a paragraph, and is to Reformers of a certain kind what the stereotype paragraph about the gigantic gooseberry used to be to the provincial editor. Mr. Bright advises his friends at the Crystal Palace to get the ballot; and we can imagine his look as he closed the letter and gazed out to see what sort of a day it was going to be. So, of the two great guns invited to the Potter banquet, one answers with a lesson and the other with a platitude.

The rest of the celebrities were Mr. Ayrton and Sir John Bowring. What induced the former, who is an able and useful man, to attend at such a dinner may be better known to his election committee than it is to us. He was the only metropolitan member who came, and his speech was mainly devoted to well-deserved praises of Mr. Gladstone. Sir John Bowring is an aged gentleman who has done good work in his time, and has amply earned indulgence for any manifestation that his judgment is not quite so vigorous as when he edited the *Westminster Review*, and he can afford to march through Coventry in any society he pleases. But neither of the gentlemen had anything to say, in the ordinary acceptation of the term; and we have no doubt that both were pleased to find that they had an audience which was not likely to be critical in return for condescension. Mr. Potter stated that he had expected Mr. Gladstone to come, an expectation in which Mr. Potter must, we should think, have been solitary; but he was good enough to say that the right honourable gentleman's absence would make no difference in the sentiments with which the meeting would regard him. This will be gratifying to Mr. Gladstone, who might possibly be afraid that his declining to witness the Reform gymnastics and Reform fireworks would injure him in the estimation of the nation. We cannot forget that a few weeks ago an eminent member of the Potter clique, a shoemaker, we think, was understood to have spoken in a depreciatory manner of Mr. Gladstone and Mr. Bright, and a solemn debate was held on the subject, and it was not until the shoemaker had avowed that he still retained confidence in those gentlemen that, after expressions of delight from the president, business could go on. It was, therefore, thoughtful in Mr. Potter to anticipate any peril to Mr. Gladstone's peace of mind. The utterances of the regular Potter staff we have not perused, but have no doubt they were worthy of the occasion, and also of orators who, on another evening, used language in reference to the Emperor of the French, for which, were not the speakers so contemptible in station and influence that it matters not what cackle they emit, they might be made to suffer. They are utterly unworthy of notice; but what can be said of the temper of an audience that can listen to vulgar abuse of the Sovereign of a neighbouring and friendly country, and can hear him charged with being, when in England, a constable opposed to an honest cause (this being the Charter—a notorious swindle), and also with being privately vicious. Such things will be copied into French journals, and commented on by those who do not understand English political men and the difference between them and the public-house orators who amuse the lower orders. We beg any French readers who may come upon the brutalities to which we refer to comprehend distinctly that they have less influence upon the opinions of Englishmen than a handful of mud flung by a scavenger against a gentleman's window would have upon his friends. This kind of talk might, however, reasonably be expected from men who, having done nothing to help progress, and having done all to hinder it which could be effected by violence and nonsense, have the impudence to claim the credit of carrying the bill, and actually dine together in honour of the exploit.

So ends the first banquet in honour of Reform. Mr. Beales and his men have been warned, and perhaps fear that their feast might go off even worse than Mr. Potter's; so they have postponed it, which is a piece of wisdom. That they will abandon it altogether we can hardly hope, because it is absolutely necessary for Mr. Beales to air his patriotism every now and then, lest it should be forgotten. But it is as well that the folly should be put off. Mr. Beales himself was present when the offensive language to which we have adverted was used by a Reform speaker, but did not call the man to order; nor did he afterwards express disapprobation of such talk. In the company in which his chief feats are performed, Mr. Beales may have forgotten some of the usages of society, and we are rendering him a service in requesting him to consider whether it is likely that men of the stamp of Mr. Gladstone and others in whose good graces he desires to be will care to support and countenance a person who allows offensive language to go unrebuked. At present public feeling in England is in favour of the old tradition that public men should be gentlemen. How long this sentiment may endure we are not called upon to say; but the present party leaders will probably retain it, even at the price of losing the good opinion of our new masters. Meantime, it is not a pleasant thing for the historian of Reform to have to set down that the passing of the bill has been commemorated by an impudent and arrogant assumption, and that the so-called Reformers are persons who insult a kindly-hearted and friendly Sovereign.

THE COURT.

The Queen, with Prince and Princess Christian of Schleswig-Holstein and the junior members of the Royal family, continues at Balmoral Castle.

On Tuesday week her Majesty, accompanied by Princess Louisa, left the castle, on a visit to the Duke and Duchess of Richmond, at Glenfiddich. The Queen drove from Balmoral, viâ the Gavin Water and the Castle of Corgarff, to the Cock Bridge, on the Don, whence her Majesty rode eight miles across a low chain of the Grampian Hills to Tomintoul, and drove thence to Glenfiddich Lodge. Prince and Princess Christian drove out. Prince Christian went deerstalking in Glen Gelder, and brought down two stags. Prince Arthur and Prince Leopold drove through Ballater to the Vale of Cromar, and visited Sir James Clark at Tillypronie. The Right Hon. Gathorne Hardy left the castle.

On Wednesday week Princess Christian and Princess Beatrice, accompanied by M. and Mdme. Van de Weyer, had a picnic on the heights adjoining the deer forest. Prince Arthur went fishing in Loch Muick.

On Thursday week Prince Arthur and Prince Christian went deer-stalking around Lochnagar. Princess Christian and Princess Beatrice drove to meet the Princes upon their return from the forest.

Yesterday week the Queen, accompanied by Princess Louisa, left Glenfiddich, upon her return to Balmoral. The route traversed was by Dufftown, Glenrinnes, Glenlivet, Tomintoul, the castle of Congarff, and Gardenshiel, to Balmoral. Prince and Princess Christian and Prince Arthur drove out.

On Saturday last the Queen, accompanied by Princess Christian, Princess Louisa, and Princess Beatrice, walked and drove out. The Right Hon. Sir Stafford Northcote arrived at the castle, as the Minister in attendance on her Majesty.

On Sunday the Queen, Prince and Princess Christian, Princess Louisa, Prince Arthur, and Prince Leopold attended Divine service in the parish church of Crathie. The Rev. M. Taylor, minister of Crathie, officiated. The Hon. Mrs. Gordon, Sir Stafford Northcote, and the Rev. M. Taylor had the honour of dining with her Majesty.

On Monday the Queen, accompanied by Princess Christian, Princess Louisa, and Princess Beatrice, honoured Sir James Clark with a visit at Tillypronie. Prince Christian and Prince Arthur with Sir Stafford Northcote, went to a drive of deer in the woods M., Mdme., and Miss Van de Weyer had the honour of dining with her Majesty.

The Crown Prince and Crown Princess of Prussia, with their children, are expected to arrive in England about the 16th inst., on a visit to the Queen.

THE QUEEN OF HOLLAND.

The Queen of Holland, attended by the Baroness von Pabst, Baroness van Dedem, and Count Byland, took leave of the Earl and Countess of Derby and left Knowsley on Tuesday, upon her return to the Continent. Her Majesty travelled to Southampton, and embarked in the evening on board the Dutch war-steamer Falk, Captain Koopman, for Cherbourg, en route for Paris.

THE PRINCE AND PRINCESS OF WALES.

The Prince and Princess of Wales continue at Wiesbaden. The following gratifying announcement was made on Tuesday evening at the annual dinner of St. Bartholomew's Hospital by Mr. Paget, who has just returned from Wiesbaden, he having been in attendance upon the Princess since her departure from England:—"It is a great pleasure to me to state that the health of the Princess was, at the time of my departure from Wiesbaden, on Sunday last, superlatively satisfactory. Those who sit around me can appreciate the gravity of the affection under which her Royal Highness was labouring, and it is with profound and heartfelt pleasure that I am enabled to announce to you, by the permission of the Prince of Wales, that the limb is progressing most favourably, and that her Royal Highness will shortly return to England, fully capable of participating in all duties and pleasures connected with her exalted rank and very great popularity."

METROPOLITAN NEWS.

Mr. Joseph Causton was, on Monday, elected to fill the office of Alderman of the Ward of Bridge, vacant by the resignation of Mr. Alderman Abbiss.

The medical schools connected with the hospitals of the metropolis were opened on Tuesday. Introductory addresses were delivered, and prizes distributed to successful students.

Pheasant-shooting began on Tuesday morning, and at an early hour pheasants were sold, at from 8s. to 10s. per brace. These early birds were in good condition and full plumage.

The guardians of the poor of St. Pancras have determined to provide a new infirmary for the sick poor in their workhouse, and for this purpose have agreed to purchase three acres and a half of land lying between Malden-lane and Swain's-lane, Highgate, at the rate of £1150 per acre.

Mr. George Potter's Reform banquet took place at the Crystal Palace on Monday night. About 500 persons were present. Mr. Potter himself was in the chair. The only member of Parliament present was Mr. Ayrton. Letters were read from Mr. Gladstone and Mr. Bright excusing themselves for non-attendance.

On Saturday the new Sheriffs, Messrs. Alderman Stone and W. M'Arthur, having entertained their friends at breakfast, were afterwards sworn in with the customary formalities at Guildhall. Later in the day they presided at a common hall, at which Mr. Allen, the senior Alderman below the chair, was elected as Lord Mayor for the ensuing year. The present Lord Mayor had a banquet at the Mansion House in the evening.

A meeting convened by Mr. Edmond Beales was held, on Tuesday night, in St. James's Hall, to sympathise with Garibaldi. The meeting, in the first resolution, denounced the Italian Government, and in the second protested against the men of Rome being compelled to submit to a Government supported by hireling foreign troops. Ricciotti Garibaldi spoke to one of the resolutions.

Last Saturday morning three of the performers at a music-hall in Holborn were on their way home when they were attacked by three men, said to be Irish, who used firearms and wounded one of the musicians, M'Donnell, a bandsman of the 2nd Life Guards. The bullet entered the poor fellow's chest and passed through his back, causing an injury which, it is feared, may prove mortal. John Groves, who is or has been a sergeant in the London Irish volunteer corps, is in custody on suspicion of having been one of the assailants. Groves is alleged to be what is called a Fenian sympathiser. Papers found at his lodgings have been ascertained to be from persons now Fenian prisoners in Mountjoy Prison.

The births of 2136 children (1122 boys and 1014 girls) were registered in London last week. In the corresponding weeks of ten years, 1857-66, the average number, corrected for increase of population, is 2044. The deaths registered in London during the week were 1194. It was the thirty-ninth week of the year, and the average number of deaths for that week is, with a correction for increase of population, 1272. The deaths in the present return are less by 79 than the estimated number. The deaths from zymotic diseases last week were 324. The deaths of 103 children and 5 adults from diarrhœa were registered last week; 10 cases occurred in the west, 25 in the north, 18 in the central, 27 in the east, and 23 in the south districts. The deaths from diarrhœa during the last four weeks have been 198, 203, 114, and in the present return 108. The deaths of 15 persons from cholera or choleraic diarrhœa were registered last week. In the corresponding week of last year the deaths from diarrhœa were 67, and from cholera 177. The deaths registered last week from smallpox were 17, from measles 14, from scarlatina 32, from diphtheria 7, from whooping-cough 26, and from typhus 26. The deaths from phthisis were 138, from bronchitis 67, from pneumonia 41, and from heart disease 42.——Last week 4607 births and 2857 deaths were registered in London and in twelve other large towns of the United Kingdom. The annual rate of mortality was 24 per 1000 persons living. The annual rate of mortality last week was 20 per 1000 in London, 23 in Edinburgh, and 22 in Dublin; 16 in Bristol, 26 in Birmingham, 31 in Liverpool, 28 in Manchester, 29 in Salford, 26 in Sheffield, 32 in Leeds, 29 in Hull, 34 in Newcastle-on-Tyne, and 25 in Glasgow. The mortality from diarrhœa in the ten large English towns continues to decrease, but is still considerably greater than is usual so late in the year. The total deaths referred to this disease in the ten towns, which in the three previous weeks had been 507, 577, and 436, fell last week to 336, of which 106 occurred in London, 62 in Manchester and Salford, 33 in Birmingham, 26 in Sheffield, and 25 in Liverpool. The annual death-rate per 1000 from this cause during the week was 2 in London and Bristol, 3 in Liverpool, 5 in Leeds and Newcastle, 6 in Sheffield, 7 in Manchester and Salford, and Hull, and highest, 9 per 1000 in Birmingham. Scarlatina was fatally prevalent in Manchester, Liverpool, and Birmingham.

THE MAGAZINES.

The *Cornhill* is, as usual, a very pleasant miscellany of agreeable fiction and matters of fact so treated as to be almost equally agreeable. Every one will gladly welcome the lady who has already enriched the literature of the time, and not merely the ephemeral literature of the day, with so many charming adaptations of fairy stories to the circumstances of modern society. "Little Red Riding Hood" will rank with the best of her efforts for delicate humour and elegant unstudied grace. The characters are chiefly French. Mr. Lever's story pursues its diversified yet equable course, nowhere very brilliant or very exciting, yet with a spirit of geniality diffused throughout which, open it where you will, renders it pleasant reading. The special feature is that knowledge of the habits and feelings of foreigners, and the light in which English matters appear to them, which Mr. Lever's prolonged residence on the Continent enables him to possess and apply with much effect. Familiar things acquire piquancy when regarded from this novel point of view. "Witch Murders in India" is a remarkable account of the superstitious belief in witchcraft which obtains in that country, and which can be scarcely distinguished from that which prevailed over Europe 300 years since. The resemblance of the social condition of India to that of mediæval Europe has frequently struck us, and the present is one of the most remarkable instances. "Jottings from the Note-book of an Undeveloped Collector" include some very interesting anecdotes of the auction-room, winding up with a touch at the notorious Simonides. "Saint and Sinner," a poem, is a coarse and repulsive imitation of Mr. Robert Browning, whose manner anyone can copy, but whose spirit is not to be reproduced by imitating the mechanism of his verse and the abruptness of his phraseology. "A Gossip on our Rosalinds" is amusing but solely written to lead up to a puff of an actress who has recently been performing in the part. The effect is somewhat that of those paragraphs which begin with the solar system and end with Professor Holloway.

The *St. Pauls Magazine* will be expected with the curiosity due to one to whom readers are under so many obligations as Mr. Trollope. So far as that gentleman and his coadjutor in fiction are concerned, no disappointment will be experienced. "Phineas Finne," Mr. Trollope's own story, may move a little stiffly at first; but it affords promise of great amusement when the subject is more fully developed. Mr. Trollope finds himself on ground well adapted to display his strength, and even in these preliminary chapters the sketch of the Parliamentary whip is a masterpiece. "All for Greed," the scene of which is laid in France, also promises to be a good and original story. The rest of the contents, however, resemble inferior *Cornhill* articles considerably the worse for wear. Subjects of no less importance than the Reform Bill, monarchical institutions, and the laws of taste are so treated as effectually to deprive them of interest. One would think the conductors had done what in their introduction they declare they will not do, "get their padding cheap, because no one ever reads it." We hope to observe a considerable improvement next month.

Macmillan is remarkably good this month. The first and most important article is one by Professor Masson on the condition of the University of London, and the feasibility of reorganising it on a scale corresponding to the magnitude of the metropolis. Professor Masson's views will command the greatest attention, for few are so well qualified to express an opinion on this important subject. "Old Sir Douglas" is completed, retaining its vigour undiminished to the last. Two new novels, by Mr. Helps and Miss Yonge, are announced to take its place and that of Mr. Kingsley's story. M. von Bothmer draws a melancholy picture of the contempt into which the Protestant clergy of Germany have fallen. The prosaic but valuable moral of his remarks seems to be that, if a Church is to retain any influence over the better classes, it is absolutely necessary for it to be sufficiently rich to admit of the clergy being drawn from the higher orders of society. Hear this, ye indiscreet reformers! Mr. Dawkins describes the career of Brother Prince of the Agapemone, and arrives at the conclusion that he is a sincere fanatic. "Eating and Drinking in America" and "Surveying in Eldorado" are very clever and entertaining papers. Archbishop Trench's translation from the Georgics is chiefly remarkable as the work of an Archbishop; but "Evenings at Home," if somewhat uncouth in structure, is a real poem, piquant and original in no common degree.

Fraser, as *de rigueur*, has an article on the Paris Exhibition, which appears to be written with much intelligence. "The Irish Church in the Time of Queen Elizabeth" is remarkable as the production of an Irish clergyman, who casts the heaviest imputations on the succession of his own Church, and recommends its abolition. "Rambles" contains a vigorous sketch of William Cobbett. Browning's "Sordello" has found an able and appreciative interpreter in Mr. Dowden; and "The Village on the Cliff" and Admiral Slade's memoirs of the Crimean War are reviewed with ability. A sketch of the city of Washington is exceedingly graphic.

There is nothing remarkable in the *Argosy* except "Robert Falconer," which maintains its level, and the opening of what promises to prove a pretty story by Mr. Gilbert, "The Magic Flower." The rest of the contents are of very slight texture.

The *Fortnightly Review* has one article which will both attract and repay great attention—a review of Mr. Arnold's poems by Mr. Swinburne. Like most of Mr. Swinburne's prose writings, it is a kind of unmetrical dithyramb, eloquent and melodious, but choked with similes, glowing with all the colours of the rainbow, and swollen with superlatives. Such fierce transports of alternate rapture and animosity at most savour of the ludicrous; they attest the great immaturity of the writer, and the disproportion which as yet exists between his powers of language and his powers of thought. When, however, Mr. Swinburne is translated out of his own dialect into that of his fellow-creatures, we find little with which we cannot sympathise; his criticism is in general just, and his warm appreciation of his contemporary is as creditable to his feelings as to his taste. We sincerely trust he may be profited by his study of Mr. Arnold, whose teaching and example seem precisely calculated for such a case as Mr. Swinburne's. The magazine also contains a paper by Mr. Stirling on De Quincey, Coleridge, and Kant, the non-metaphysical portion of which is very interesting; an account of the chief American universities, and a paper on art, which, beginning with supernatural solemnity, resolves itself at last into a puff of a particular clique of painters.

The third number of *Tinsley's Magazine* is less entertaining than its predecessors, so far as the miscellaneous papers are concerned. Mr. Yates' and Dr. Russell's stories, however, are continued with undiminished spirit. "Yachting" is amusing. "Aunt Anastatia" is very hard on the morality of modern novels, but somehow passes by notorious offenders to lay hold of a couple of which we must confess we had never heard. On the other hand, she is very enthusiastic about "The Waterdale Neighbours." We suspect that our good aunt is a publisher.

The *Dublin University* winds up Mr. Lefanu's "Tenants of Malory," on which it has mainly subsisted for some time past. Like this gentleman's other works, this novel belongs to the melodramatic school of fiction; but it is one of the best specimens of its class, being written with immense power of style, and offering a constant sequence of exciting incident, with characters forcibly but rudely drawn. Mr. Mortimer Collins (as we guess) seems bent upon producing a work of the same class in "Sweet Anne Page," but as yet his success is not conspicuous. "A Railway Adventure" is a powerful short story. Balzac's eccentric life affords materials for an interesting paper, chiefly made up from a recent French work. It seems marvellous how so complete a hermit, and one who toiled so incessantly at his desk, should have accumulated the immense mass of minute knowledge of detail evinced in his writings. "The War Poetry of the South" contains some spirited examples, with not a little bombast and nonsense. The writer is egregiously mistaken in imagining that the Confederates enjoyed a monopoly of the muse, whose favours, both as regards quantity and quality, were pretty evenly distributed between the contending parties.

"Birds of Prey" is concluded in *Belgravia*; but the subject has so expanded in Miss Braddon's hands that a sequel is promised. It will be ranked, we think, among the best of her fictions. "Dead Sea Fruit" is comparatively commonplace, although there is much merit in the portrait of the clever but unsteady literary man. "Diana Gay," by the author of "Bella Donna," begins with much spirit.

London Society is gay and sparkling, as of old. A new story—"Waverney Court"—is commenced in the *St. James's Magazine*. It promises well, and there is much varied and agreeable reading in this miscellany. The same may be said of the *London*, where "Roger's Wrong" concludes, having earned the character of a really good story. The *Victoria* contains some interesting matter, but is deeply impressed with the character of an amateur magazine. The papers on "English Hymnology" in the *Monthly Packet* possess considerable literary interest. The *Intellectual Observer*, the *Popular Science Review*, and the *Floral World* contain special information well adapted to the demands of their respective circles of readers.

NATIONAL SPORTS.

The past week has not been a very lively one in point of sport. Challoner has been uncommonly lucky across the Channel in that gay La Grange jacket which his poor brother-in-law, Harry Grimshaw, once wore, as he won both the Omnium Handicap and the Grand Criterium. England was obliged to send over a strong contingent of light weights to its ally for the former race, as there was quite a Gallic dearth of the article. The press has been drawing attention to the fact of the Duke of Beaufort withdrawing Lord Ronald from the October Handicap after his number was up because the market had been forestalled, and it is most curious to know whether the Duke's "explanation" was satisfactory enough to save him from the Jockey Club fine in such cases. Custance, the jockey, has in his turn become a censor of the press, and has been fined £2 and costs at Newmarket for assaulting a writer who had made some unjustifiable remarks upon his riding of Achievement in the Oaks. Sam Rogers is very much better, and on the Heath once more. Honesty's friends back their horse for the Cesarewitch as if there was nothing else in the race, and Success is at 1000 to 1. Savernake is out of work, and likely to rest content with his two firsts, two seconds, and two thirds. It has been a most curious career.

The Newmarket First October was not a very first-rate meeting, and the fields for several good stakes were sadly short. On the Thursday Dalesman won a Queen's plate over the Beacon course against Leybourne, Goodwood, &c., in a style which delighted the backers of Lothario; and Daley, who is in immense riding form, followed the stale Challenge most patiently in his match with Julius, and "got" him half way up the cords. Tregeagle and Franchise (own sister to St. Albans and Savernake) cut up very badly in their race with Uncas, and Mr. Batson delighted the villagers of Horscheath by at last winning a little stake. They had, however, to mourn on the same day over Suffolk (whose dam resides in the parish, with a Vedette filly at her foot), as The Earl fairly chopped him down in the Rutland Stakes, and his Derby dream was ended. Mr. Chaplin's thousand-guinea filly, Inspiration, by Newminster from old Canezou (who is believed to be in foal to De Clare), won a maiden plate in a canter; and twice over Traviata (Custance) and L'Africaine (Challoner) made a dead heat of it for a chicken sweepstakes of £40. It seemed like a dead heat till near home in the third attempt, when L'Africaine gave way. Some odd matches have been made for next week, in two of which Lord Westmoreland is to ride 14 st. 5 lb., on his two-year-old The Star. The Marquis of Hastings is matched to ride The Earl (14 st. 5 lb.) against his Lordship in one of them; but we conclude that it will hardly come off. The most important match is one of 1000 (half forfeit), over the Bretby course, in which Julius gives 9 lb. for his year to Lady Elizabeth, for whom the Middle Park Plate is booked as a certainty.

The list-keepers have combined to defend themselves against the "bagmen," and intend to test the Doncaster magistrates' decision in the superior courts. Nearly £700 has been contributed already to the "Defence Fund,"

Mr. Blenkiron has added to his brood mares La Dauphine (500 gs.) and Bianca (550 gs.). Mr. Jackson purchased the half-mile flyer Nutbush (600 gs.) at Mr. Mather's sale; but Mr. Blenkiron would not pass her Trumpeter colt foal (400 gs.) Baron de Maltzahn bought pretty largely at the latter sale, and so did Lord Scarborough. Lord Stamford had no attendance at his Newmarket sale of yearlings, which was rather surprising when we remember how Derventio of the Citadel blood was knocked down for 820 gs. at Doncaster. Mr. Robert Smith's cobs and galloways sold at all prices at Bristol—from 25 to 76 gs.—and twenty of them averaged 32½ gs. Forest Queen by Lord Exeter's Nutshell, from a cob mare, made 76 gs., and her half-brother, Nutshell, 54 gs. The Messrs. Tattersall had a very fair sale for Mr. Knight's Exmoor ponies at Birmingham. Just fifty of the little mosstroopers were put up, and sixteen of them fetched all prices from £15 to £27. Five of them were sold at £20 and upwards. The blood sires Jonquil and Tippler have been sold to go abroad, and Captain Barlow has also parted with his chestnut horse False Alarm by Trumpeter to Lord Middleton. We have no doubt that he will follow up his Islington and Bury Royal victories with some more in the Yorkshire rings. Few horses are a better model of what a good hunter should be.

The coursing season opened again on Sept. 25 in Scotland (with Mr. Hay as judge) over the estates of the Earl of Home. Mr. Gibson, as usual, was dreadfully unfortunate, and all his five puppies were put out in their first courses for the Scottish National St. Leger, which was ultimately divided between Lord Lurgan's Master Ivo and Mr. Blanchard's Bab-at-the-Bowster. The Douglas Cup, the entry for which was not remarkable, was won by Improver by Patent. Mr. Warwick donned his scarlet on the following day at Brampton. Crossfell by Canaradzo and Lion's Share by Cardinal York divided the cup; and Falling Spray by Canaradzo ran up to Bandmaster by Clansman for the Kingwater (Puppy) Plate. Johnny Cope has been out again at the Border Union Meeting, but he was beaten by Romeo for the Roxburgh Stakes in his second course.

WILLS AND BEQUESTS.

The will of the Right Hon. Jane, Countess of Kilmorey, has just been proved, in the London Court, under £1500 personalty; and the will of Lady Rachel Oliver, under £30,000.

The will of John Rogers, Esq., formerly of Upper Tooting, and late of River-hill, near Sevenoaks, Kent, was proved in London, on the 18th ult., under £160,000 personalty. The executors are John Thornton Rogers, Esq., the son; Henry Blackburn, Esq., of The Hollands, Kent; and the Rev. Francis Vansittart Thornton, M.A., of Chilton Candover, Wilts. The testator executed his will in 1862; and died, Aug. 12, 1867, at the Hotel de la Metropole, Geneva. He has made a liberal provision for his wife, and has apportioned to his younger children the sum of £50,000 left under the will of his late father; also a legacy of £5000 to each, besides other interests under the will. To his eldest son he leaves his real estate and the residue of the personalty.

The will of Edward Starkie Tuton, Esq., late of Laurel-road, Fairfield, was proved at Liverpool, by his niece, Miss Martha Frances Dempster, and James Mather, of Warrington, the joint acting executors. The personalty was sworn under £30,000. He has made liberal bequests to his brother, sister, nephews, nieces, and cousins; and has divided the residue of his estate, both real and personal, into six parts, amongst his nieces. There are legacies to his servants, and bequests to twenty-one institutions. Amongst them are the following:—The Church Missionary Society, Wesleyan Missionary, London Missionary, British and Foreign Bible Society, each £300; the Society for Promoting Christianity amongst the Jews, Liverpool Royal Infirmary, Sunday and Day School; St. Andrew's, and the Central Relief Society, Liverpool, each £100; the Southern and Northern Hospitals and the Liverpool Dispensary, each £50; and a like bequest to other local charities.

The will of Miss Eleanor Sarah Robinson, of Holmfield, Aigburth, was proved at Liverpool by her nephew, William Fothergill Robinson, jun., of New-square, Lincoln's-inn; and William Gandy Bateson, of Liverpool, solicitor, the joint acting executors. The personalty was sworn under £30,000. Miss Robinson executed her will in 1863. After making some bequests to her nephew and executor W. F. Robinson, including the epergne presented to her late brother James Robinson by the committee of the Liverpool Union Bank; she also leaves to him for his life several paintings and pictures which are to pass to his children; but, in the event of there being no issue surviving, they are to devolve to the South Kensington Museum. The residue of her property, real and personal, she leaves amongst her nephews and nieces.

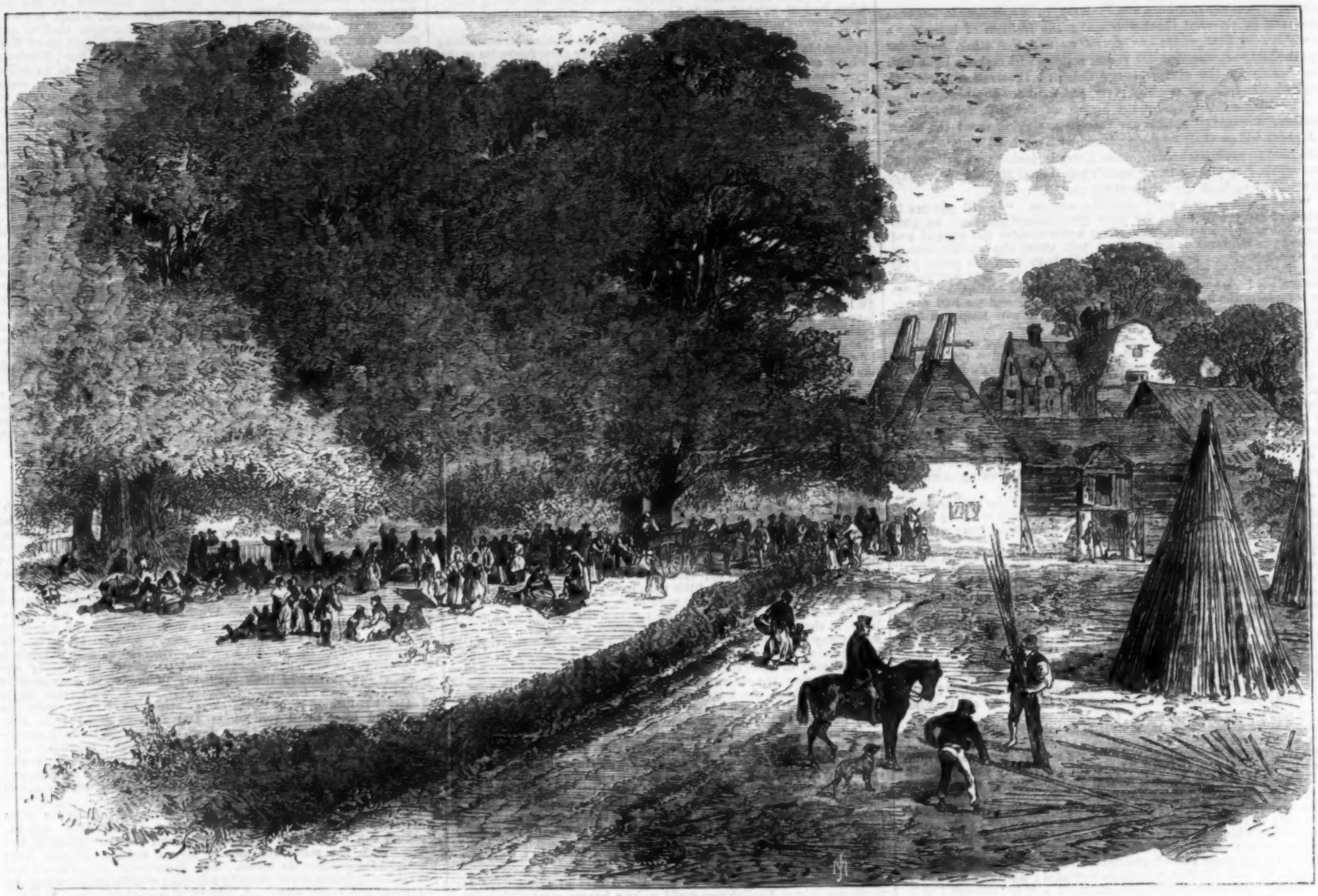
The wills of the undermentioned have been proved:— Benjamin Cleave, Esq., of Newcombe, Devon, under £60,000 personalty; Miss Rachel S. Anderdon, of Hammersmith, £40,000; John Blagrave, of Calcot Lodge, Tilehurst, Berks, £30,000; Solomon Leonard, of Clifton (proved at Bristol), under £30,000; Benjamin Scott Riley, Esq., of Bath, under £50,000 personalty; he has left to the Liverpool Infirmary £4000, and bequests to other charitable institutions.

INCIDENTS OF HOP-GATHERING.

DINNER-TIME.

HOP PICKERS SHIFTING GROUND.

INCIDENTS OF HOP-GATHERING.



WAITING TO BE PAID

PAYING HOP-PICKERS.—SEE NEXT PAGE.

THE COLOURED ILLUSTRATION.

"HOP-PICKING."

THERE was Love, and there was Jealousy, to sow dissension between two fond hearts—and those who make the frailties of humanity a study believe that where one grows we find the other, never far apart—and so it was that the young maiden who makes a light with her beauty in the centre of our Coloured Illustration parted in high disdain from her wealthy lover, and went out hop-picking.

"I cannot sit moping by the hearth all day with folded hands, mother," she said; "neither am I one to go singing about the house 'A green willow shall be my garland,' with my head hanging aside, like Shakspeare's Barbara, because Harry is jealous. I will go out among the hop-pickers in my uncle's plantation. He said, yesterday, it would bring back the colour to my cheeks."

"And I will go with you," said the mother. "It will put me in mind of my young days; for your grandfather made all us girls turn out at hopping-time, while your uncle cleared the ground and brought us the bines to strip. They talk about the trouble there is in growing choice flowers; they should have seen the pains your grandfather took with his hop-garden to get the first pocket into the market! We used to begin tying up early in spring, and keep on long after the hops were beyond our reach, except we had something to stand upon. You want a change; it will keep you from thinking so much. We'll go to-morrow."

The uncle lived at the old-fashioned farmhouse that overlooks the river, and which the family had occupied through five generations. His sister and niece, who were to go into his hop-garden on the morrow, resided in the village, close by. The mother was a widow; and the daughter, who was called in the neighbourhood "The Fair Maid of Kent," was on the eve of marriage with the son and heir of one of the wealthiest landholders on that side the county, when Love and Jealousy sowed dissension between them, and this was the cause:—

"You did not come to meet me last night, as you promised, when I returned from my uncle's," said Marian on the following morning, as she met her lover in the garden without a smile.

"I came, as you knew I should after promising," he replied, looking very grave. "I was in the lane when you were walking along the footpath inside the hop-ground. Charles was with you; and you spoke so loud I heard all you said."

The colour rose in her face as she said, "Though I was not aware that we had a listener so near, I am glad we spoke loud enough for the treason we were plotting to be overheard." And the sweet smile came back as she thought of the conversation he had heard between herself and her cousin Charles.

"What I heard caused me to return without speaking to you," he replied; and there was a tremor in his voice. Then, fixing his eyes full on her face, he added, "Shall I repeat it to you?"

She gave her head a saucy jerk, and, with a mocking courtesy, bent forward, as she said, "Certainly. I am all attention."

There was a troubled look on his countenance as he said, "I have ever found you truthful. Did you not say, 'I will do all that lies in my power to make you happy'?"

She was silent for a few moments; then said, "I did, using those very words; but'——

He interrupted her sharply, and said, "Enough; they need no qualifying. Did you not also say, 'I know how worthy you are; and the heart that will not sacrifice wealth for affection is unworthy of acceptance'?"

She replied, "I did, nearly word for word. It is all true. Proceed."

He did; and repeated much more he had overheard to the same purport, and which, looked at from his point of view, seemed "confirmation strong as Holy Writ."

When he had made an end, she drew herself up to her full height, and said, "I said all that you have repeated; and since, when I offered an explanation, you cut me off with a rude 'Enough! it is not needed,' I now say, if you believe that what I said was to deceive you, you must think me unworthy of all further notice, as I do you only to entertain such a belief of me."

He looked confused, and, after a short silence, said, "I did not say it was done to deceive me. I did not think"——

She raised her hand and said, "Hush! To doubt my sincerity is to have less faith in me than you had beforetime—is to love me less. If you believe me not to be truthful you must love me less than when you believed that I was. Is it not so? If I am less perfect in your eyes than I was yesterday, what may I be to-morrow? And what if every to-morrow keeps revealing some fresh imperfection? Harry, you do not love me as you did, or you could not doubt my truthfulness."

There was some subtlety in her reply rather difficult to answer; for the plain meaning was he deceived himself by still loving her if he believed her to be what he said, while she would become lessened in her own esteem by countenancing a lover who believed her to be untruthful. He spoke long and well—for he loved her very dearly—of showing a tenderness for the failings of those who are endeared to us; that love would be less were the object more perfect; that the child is not the less endeared to its mother after it has been chidden, but caressed more fondly.

That did it.

"I am not a child, to be chidden, then kissed and have sugar given to me." And she went inside, closing the cottage door with a bang, and leaving him standing in the garden, feeling that he had gone too far and regretting that he had waved her off with that unlucky word "enough" when she was about offering an explanation. "She is as proud as she is beautiful," he said to himself, as he walked away; "and it might be Margaret they were talking about, after all. I have been too hasty."

So it has ever been since Love first drove his sharp ploughshare over the human heart; Jealousy followed and sowed the newly-made furrows, and in them this bitter-sweet has ever since grown.

She went out with her mother into the beautiful hop-gardens, where the vine-shaped leaves are shot through and through with the golden shuttle of heaven, that weaves fanciful patterns on the trailing bines; carved cones and graceful tendrils, diapered in the green and sunny woof that throws a pleasant shade on the level alleys between. A glimpse of her standing there, as she sometimes did alone, musing, at a leisure hour, with great drops of gold falling on her—from the sunshine that came through the trellis-work of leaves—was a picture that made one hold his breath while looking at it, so perfect was its beauty. The drowsy air that floated around when the hop-pickers were resting in the hot noon-day silence made it like an enchanted land, resembling neither forest, field, nor garden, but more like something that had sprung up in a night, for the ground between the hop-walks was barren until a few brief weeks of showery spring and sunny summer had hung that land in green and gold. Silent fingers had twined those tendrils in the still night by the light of the moon and stars, and we looked on in wonderment in the morning to see how much higher they had led the tender shoots, which a careless touch severs. One might fancy that the drowsy air in the hop-gardens had lulled all the singing-birds to sleep through their silence, did not the changing foliage around remind us that when they saw autumn advancing, they winged their way across the sea.

Marian's uncle, though only a plain English farmer, was a man of taste, and in one of the embowered entrances to his vast hop-gardens he had planted convolvuli and woodbines, which, twining around the poles, mingled with the hops, so that the red-streaked trumpet-shaped honeysuckle was overhung with the imperial purple of the vase-shaped convolvulus, while the dead gold of the hop-cones drooped about like tiny pineapples in all kinds of graceful forms, such as art tries in vain to imitate. Nature held up the spray for a moment in her invisible fingers, as if to see how it looked; then threw it aside with a swing, for the breeze to blow about and the sun to shine through, and the rain drops to tread upon as they danced about with silver feet, while the golden-banded bees made a murmur of music to the rustling of the foliage. Marian had an eye that appreciated all these beautiful objects, and, although she must have remained silent while others delivered their opinions of the last new novel, yet no sooner were the names of Spenser, Shakspeare, and Milton introduced than she also "knew a bank" and a shady place "by the trees' own inclination made," and could tell how Eve looked when "she stood half-spied, so thick the blushing roses all about her blowed." And how could she help loving Harry, when he had pointed out to her the stars that lay broadcast on the open heaven of their pages?

And Harry! he went moping about like one looking for something invaluable that is lost. He "daundered" along their favourite walks, where every object recalled her; though the fairest of all, in his eye, was absent, for her sweet face was the loveliest spot to turn and look upon after all the surrounding landscape had been admired. To him there was no sunshine anywhere without her smile.

He saw the crimson hep of the wildrose on the hedges, but missed the lips that rivalled it in colour, yet had not their yielding sweetness, even when the rose was in bloom. The blue of the late autumn violet only recalled the azure of those eyes that were no longer there to look down upon it. The rich brown gold of the foliage, which the kindling fingers of autumn had fired, brought back her heavy fall of auburn hair, which seemed to be ever changing in hue as the shifting sunlight played about it. The walks which her presence made short and pleasant now appeared to him long and weary, for Love, that always hovered round, seemed now to have spread out his wings and flown away. He threw himself down among the fallen leaves—the beautiful pall under which summer lay dead—and thought how many forsaken lovers since Time began must have longed for such a gorgeous and silent bed to lie down and die upon. So he lay on his elbow and side, looking, as our old poets say, "All love-lorn and woe-begone," when he was hailed by a cheery voice, exclaiming, "Hillos, Harry! what are you 'mooning' about there? Maggy has gone a hop-picking with Marian, and I am going to see how they are getting on. Come with me." It was Charley, who unintentionally had sown dissension between hearts that loved.

As it made the pretty hop-picker rather sad at heart when she dwelt upon the "tiff" with her lover, she did what is always best under such circumstances, and thought of it as little as possible—keeping her fingers employed at the work and diverting her busy thoughts from the channel they struggled to flow into by watching what was going on around her, for there were plenty of pleasant little pictures to look at in the hop garden. The way the hop-pickers prepared their meals, the amusements of the children, their eager cries about it being time for another meal when they had only picked a handful or two of hops since they had risen from their last homely repast, delighted Marian and her companion Maggy, and reminded her mother pleasantly of her younger years.

The handy little maiden lighting the fire to boil the kettle, while her mother nursed the baby and kept her eye on the other children, who were stripping the hop-bines and hoping it would not be long before tea was ready, was a little picture that charmed Marian; the girl garlanding her little sister with hops, and the dogs looking on as if watching the progress of the rustic toilet, called up a merry laugh as she pointed out the comical group to Maggy; and there were many sketches as droll half hidden behind the foreground of our Picture. The little fellow who, unlike Puck, sat under his mushroom instead of upon it enjoying the large apple she had given him while replacing the old umbrella, had crawled up and made friends with Marian from the first moment she sat down amongst the hop-pickers, calling her his "Pitty mam-ma!" Even her grave uncle, busy ticking the hops as they were carted off to the oast-house, had a pleasant smile for her whenever their eyes met, though he did say when she offered herself as a hop-picker, as he called to his overlooker, "Here, give my niece a basket and see that she fills it before emptying it into the bin. She shall work on her own hook, be shown no favour, and have just what she earns!" Then he laughed heartily as he said, "If it were not for Harry I would add, and be forced to live upon it, like the rest of the hop-pickers." She smiled on him and said, "Dear mother often worked hard at hop-picking in her younger days, and I don't see why I shouldn't do the same." He gave his head a wise shake and said, "Ah! my dear niece, the world has altered since your mother and I were young. Hops and barley stood next to bread and beef in those days, for no thoroughbred Englishman could make a hearty meal without his jug of foaming ale. Your grandfather never cared about seeing anything else on our oaken table, while the round of beef, the brown loaf, and the foaming ale-tankard stood there. He would have called your Harry a 'muff'—noble fellow as he is—had he seen him chipping his egg, picking up his mites of muffin, and sipping his tea as he does at your breakfast table, though he would sooner have worn a beard than one of those carter's hats which your cousin Charley puts on. Harry wouldn't look like a gentleman in one, manly as he appears with his beard. They put me in mind of a pudding-basin wrong end upwards standing on a plate, as if the wearers had run away with them from before the fire, where they were placed to be kept hot. But, hillos! speak about you know who, my dear, and he is sure to appear. I must get back to my hop-ticking again. Look yonder!"

Marian and Maggy did look, and saw Harry and Charley enter the hop-garden together. "I shall go," said Marian, snatching up her basket, and looking at Harry, whose gaze was riveted on her, while Charley patiently underwent the ceremony of having his boots dusted with a bunch of hops by a pretty girl, who would have been one of the first to have lent a hand at rolling him in the hop bin had he not paid his "hopping" or "footing," as it is sometimes called. Maggy, by the motion of her hand, drew the mother's attention to the new arrivals, while the man who was cutting through the roots of the bines to liberate the polls stood, with the billhook suspended in his hand, listening to hear "how much the girl got out of the two genta," for there were dim visions of forthcoming beer in his "inward eye."

Harry and Charley had not walked down to the hop-garden in silence, for Charley told him all that passed between himself and Marian, who, except Margaret, he said, was the truest friend he ever had; that but for her intercession Margaret's parents would have forced her to marry a rich old farmer, and he should have been miserable and she wretched; that Marian promised to do all in her power to make them happy; in short, he repeated the very words Harry had overheard which made him jealous.

How the estranged lovers became reconciled no one exactly knew, except themselves; but after they had been together a little time Marian, in her poetical way, was saying to him, "Oh, Harry! I should like to have a nice arbour made in the hop-garden, and for us to live in it always, with a rain of gold upon the ground, and the aroma of hops all round to send us to sleep, whether we wanted to go or not, and to watch the tendrils waving with half-shut eyes, and to pull your beard just as you were dropping off into the land of drowsyhead, and to never be bothered with anything any more."

There was a sound behind the hops that screened them like that one makes with the lips when chirruping to a bird. Then Harry was heard to say, "But the kettle would have to be boiled, and the chops gridironed, darling; and what a draggled duck you would look at the end of a week unless you changed your dress. No, my dear Marian, there is no Arcady now, where they did nothing but pipe and dance, and the lambs came tripping up to the gentle waving of flower-wreathed crooks—were they eaten with mint-sauce, I wonder? In these degenerate days tax-collectors knock at the door, and milliners send in their bills to gentlemen, who like to see their pretty wives handsomely dressed when they themselves are too much occupied with the forthcoming fashions to call and settle 'that little account,' and"——

She placed her hand over his mouth to silence him, and said, "Oh, Harry, fie! he must be a shabby fellow who likes to see his wife handsomely dressed yet begrudges the payment of her millinery bill!"

"It 's all right," said the uncle, who overheard what they said; "they have kissed and made it up, like good children, as they are."

"And love would be very surfeiting were it all honey and sugar," replied his sister. "I used to like a dash of vinegar in the sauce to my plum-pudding when I was a young woman. They 'll be none the worse friends for this hop-picking tiff, I'll warrant." Nor were they. Harry tried his hardest to get her to put on the homely dress on her wedding-day she wore in the hop-garden, but she would not do that, though she took it with her when they went to pass the honeymoon in the Lake district; and, whether she put it on or not while there is only known to themselves.

T. M.

INCIDENTS OF HOP-PICKING.

LEAVING that pleasant chronicler of English rustic life, Mr. Thomas Miller, to tell in his own way the story of the scene depicted in our Coloured Illustration, we need only call attention to the four Engravings in the middle pages of this Number, which represent some of the ordinary incidents of that picturesque kind of agricultural industry pursued at this season in the hop-gardens of Kent, Sussex, and Surrey. The latest reports from Maidstone, Ticehurst, Farnham, and other centres of hop cultivation, lead us to believe that the crop, which is now nearly all gathered in these south-eastern parts of England, will not be a good one in quality, and the planters are disposed to hold out for better prices than have yet been current in the Borough, notwithstanding their apprehensions of the arrival of large foreign supplies from France, Belgium, and Germany. The number of hands employed in the hop-picking this year is greater than ever, as the work began later than usual and it was desirable to make the best use of the fine weather. A great many poor people from London, who during the rest of the year are occupied in various kinds of indoor work, make it a custom to go down into the country in the month of September and join the rural labourers in this not very difficult operation. The way in which it is performed is extremely simple; the hop-bines being cut about three feet from the ground the poles are lowered and placed aslant, with their upper ends resting upon a frame or bin, which has a cloth stretched beneath to receive the hops as they fall when picked off the plant. They are transferred afterwards to the baskets, and the apparatus is then shifted to another position, in order to receive a fresh set of poles and hop-bines, which are to be dealt with in the same manner. One of the Illustrations shows a party of hop-pickers carrying their whole stock of implements, with the family kettle and a basketful of provender, to the new place of employment. In a second Illustration we see a party who have stopped working for dinner, which they seem to be enjoying with such good appetites as field labour is apt to bestow. The remaining incidents, shown on the next page, belong to the important business of paying wages, which must on no account be forgotten.

PARIS FASHIONS FOR OCTOBER.

THE changes in fashion are not particularly striking this month for the weather still continues warm for the time of year, and the autumn toilettes are as yet hardly developed. The most important change is, perhaps, the abandonment of those brilliant coloured under jupes which have been the rage during the past season. Robes à deux jupes are now almost invariably made of the same material throughout, and to admit of their being worn either looped up or à queue, while the more sober shades of colour are certainly preferred to those of a brighter hue. We have, however, a new olive colour of a richer tint than ordinary, a deep orange, and a colour of the precise shade of mahogany, all of which promise to be largely patronised during the present autumn. Redingotes and polonaises are destined to supplant casaques and pardessus, for already our modistes are exercising their ingenuity in producing innumerable varieties of the former. Some are made after the style of the old-fashioned pelisse, except that they are open in front, and have small roll-collars and lappets faced with silk, with a row of buttons all the way down the skirt. These are usually worn with long black silk scarves round the waist, fastening with either bows or rosettes, and the ends of which are finished off with a deep fringe. Others are made open, in a heart-shape fashion, and are trimmed with brides, and bordered with ruches of ribbon at the bottom of the skirt.

For evening dress the long tulle of brocaded Lyons silks will certainly be largely worn during the coming season. Nothing can exceed the taste, the elegance, and the variety of the robes which the manufacturers of Lyons and St. Etienne have produced for toilettes de soirée. The Empress of the French has shown her appreciation of them by selecting something like a dozen of the most handsome ones. A particularly elegant one, intended, however, for afternoon wear, has the ground of the new claret shade, over which is scattered sprigs of sweet-pea blossoms in pink and white, with bright green leaves. Other robes selected by the Empress are of pearl grey, dotted over here and there with full-bloom roses and buds, or clusters of carnations, or pale yellow and purple tulips and white narcissus, or bunches of white and purple lilac, or with drifting autumn leaves that seem flying about in all directions. One robe of pale Bismarck shade is ornamented with jonquils; another, the ground of which is orange colour, is covered with white and damask roses, heart'seases, and hyacinths; a third, which is pale blue, is embroidered over with marguerites, the stalks of which are tied together with gold thread. Besides the robes selected by the Empress, there are many others of extreme beauty, notably one of silver grey, dotted over with a small sprig, and having broad lavender stripes bordered all the way down with small flowers, finishing in a deep lavender border at the bottom of the robe, which is embroidered over with ears of wheat, poppies, and cornflowers, with clusters of flowers partly in their natural colours and partly in neutral tints grouped in between. Another handsome robe is of deep fawn, and has bouquets of wild flowers and leaves scattered over it at regular intervals; a third is of maize-coloured moire antique, and is ornamented with rose-buds and various flowers in their proper colours, together with drooping sprigs in delicate neutral tints. One robe of deep grey is striped with a lighter shade, down which large pink roses and buds are arranged at regular intervals. One of the most tasteful perhaps among all these robes has a ground of pale straw colour, on which is embroidered clusters of large Michaelmas daisies most gracefully arranged, and having the stalks encircled with some trailing, purple flower. Another robe, the ground of which is white, is worked all over with bouquets of flowers in gold thread.

The autumn bonnets are to be the fanchon, which has already had a long run, but which will now be made in silk or marabout instead of crape or tulle; the chapeau Marie Antoinette, which resembles a very low-crowned hat cut in two, and is usually trimmed with a feather at the side and with a small lace fall behind that partly covers the chignon, and the ends of which form the strings; and the chapeau Trianon, which is commonly made with a large bow in front. Feathers seem likely to take the place of metallic wreaths.

THE ILLUSTRATIONS.

Fig. 1. Robe à deux jupes of a rich shade of brown striped with a deeper shade, the upper skirt being made to be worn à queue, or looped up with cord and tassels at each side, as shown in the Engraving. The corsage, which is made high, has a basque behind The hat is of black velvet, with feather and veil to correspond.

Fig. 2. Robe of grey taffeta, the under jupe trimmed en tablier with rows of green satin ribbon. The upper skirt, which is open in front, is bordered at the edges with similar ribbon. The sleeves have green satin cuffs and epaulettes ornamented with fringe, and from the waistband hangs a small fringed bavette both before and behind. One or two green satin ribbon bows are worn in the hair.

Fig. 3. Robe à queue in amber-coloured taffeta, trimmed at the lower part of the skirt with an entre deux of white lace, and having a narrow lace border round the teeth-shaped ornaments beneath. The shoulders and cuffs of the sleeves and the ends of the sash are trimmed to correspond. Toque Metternich in rice straw, with long maize-coloured crape veil.

Fig. 4. Robe à deux jupes of dove-colour ed poult de soie, trimmed with brides of ribbon and buttons of the same colour. The upper jupe is looped up at each side with a patte, ornamented with buttons and bordered with a biais. The corsage is made high, with square basques of different lengths fallin g one over the other, trimmed with brides and buttons like the sleeves, and bordered at the bottom with lace. Chapeau fanchon in blue tulle trimmed with white flowers, and a blue gauze veil.

A handsome testimonial, consisting of a superb silver tea and coffee service, accompanied by a well-filled purse of sovereigns, has been presented by the leading gentlemen and chief agriculturists of Jersey to John Le Bas, Esq., whose name has been so long well known throughout the United Kingdom and the United States as a breeder and exporter of that highly-prized and beautiful race of cattle called the Alderney cow.

MONETARY TRANSACTIONS OF THE WEEK.

(From our City Correspondent.)

NOTWITHSTANDING that the revenue returns are favourable, that over £600,000 will be invested this quarter on account of the Sinking Fund, and that a large quantity of gold has been sent into the Bank of England, Home Stocks have been heavy, at drooping prices. Consols, for Money, have been done at 94¼; Ditto, for the New Account, 94⅜; Reduced and New Three per Cents, 92¼; Exchequer Bills, 2os. to 3os. prem. We have very little change to notice in the value of Indian Securities.

The supply of money is still increasing, and the best bills are readily discounted in the open market as follow:—

Thirty to sixty days'	.. .. ..	1½ per cent.
Three months'	.. .. ..	1¾ "
Four to six months'	.. .. ..	2 to 3 "

The Council for India have disposed of £100,000 in bills on the various Presidencies.

At New York, on the 30th ult., gold was selling at 143½, and the sterling exchange on London was 109½.

In the Foreign House business has been dull, and the quotations are much depressed:—We quote Italian, 1861, 45½ to 46; Ditto, 1865, 68 to 70 ex div.; Mexican, 14¾ to 15½; Russian (Anglo Dutch), 85½ to 86½; Spanish Passive, 19¾ to 19½; Ditto Certificates, 16 to 16½; United States 5-20 Bonds, 71¾ to 71⅞; Massachusetts, 86 to 94.

Bank Shares have commanded little attention, but we have no change to notice in value. There has been a moderate demand for Colonial Government Securities at fully late rates. Canada Five per Cents are quoted at 88⅞; New Zealand Five per Cents, 93½; Victoria Six per Cents, 1891, 111¾.

A fair business has been concluded in the Miscellaneous Share Market, at about stationary prices:—Atlantic Bigh per Cent Stock has been done at 73½; Credit Foncier, 3¾; Peninsular and Oriental Steam, 49½; Viceroy of Egypt's Mortgage, 7¾.

Railway Shares continue much depressed, and the tendency of prices, both for home and foreign lines, is still downwards:—Caledonian, 103¾ ex div.; Great Eastern, 39¼; Great Northern, 111¾; Great Western, 47½; London and Brighton, 53¾; London, Chatham, and Dover, 19¾; London and North-Western, 119¾; Midland, 130¾; Metropolitan, 123½; South-Eastern, 68.

The return of the Bank of England shows the following results, when compared with the previous week:—

An increase of circulation of	.. ..	£1,509,605
A decrease of public deposits of	.. ..	833,657
A decrease of other deposits of	.. ..	489,461
A decrease of Government securities of	.. ..	400
An increase of other securities of	.. ..	191,052
An increase of bullion of	.. ..	85,272
A decrease of rest of	.. ..	9,563
A decrease of reserve of	.. ..	1,431,486

The circulation, including Bank Post Bills, is £31,460,899. Public deposits amount to £7,587,426; other deposits to £18,429,816. The securities held represent £26,804,615; and the stock of bullion is £14,494,115. The rest figure for £3,671,120.

THE MARKETS.

CORN EXCHANGE.—The supplies of English wheat on offer here this week have been very limited, and the importations of foreign have also been on a very moderate scale. The demand for all kinds has ruled inactive; but, owing to the smallness of the quantity on sale and the firmness of the country markets, prices have advanced fully 2s. to 3s. At this advance a retail business has been concluded both in English and foreign kinds. Barley has continued scarce, and extreme rates have been realised. In malt no change has taken place, but the amount of business passing has been limited. Oats have sold steadily, and the quotations have improved 6d. per quarter. Beans and peas have also been in fair request, at 6d. per quarter more money. The flour trade has been somewhat active, and prices have advanced 2s. per 280 lb.

Arrivals this Week.—English and Scotch: Wheat, 270; barley, 90; malt, 310 quarters; flour, 960 sacks. Irish: Oats, 4160. Foreign: Wheat, 2,360 quarters; flour, 6,000 sacks.

English Currency.—Wheat, 62s. to 75s.; barley, 34s. to 40s.; malt, 52s. to 72s.; rye, 36s. to 42s.; oats, 22s. to 34s.; beans, 30s. to 50s.; peas, 28s. to 40s. per quarter; flour, 45s. to 65s. per 280 lb.

Scotch.—New white mustard-seed has sold at an advance of 1s. to 2s. Winter tares and maize command late rates.

Bread.—The prices of wheaten bread in the metropolis are from 9½d. to 10d.; and of household ditto, 7d. to 9d. per 4lb. loaf.

Averages of Grain.—Wheat, 64s. 1d.; barley, 40s. 6d.; oats, 23s. 1d. per quarter.

English Grain Sold Last Week.—Wheat, 79,296; barley, 19,315; oats, 6196 quarters.

Tea.—There is a fair demand for good qualities, but inferior descriptions are neglected.

Sugar.—Both raw and refined sugars are firm in price, but the demand is very moderate. The stock is 104,308 tons, against 118,250 tons in 1866.

Coffee.—The market is steady, and the quotations are fairly maintained. The stock is 21,131 tons, against 16,094 tons last year.

Rice.—There is a fair business doing in cleaned qualities, but rough parcels are difficult to sell. Stock, 2384 tons, against 19,439 tons in 1866.

Provisions.—Fine Irish butters sell steadily, at extreme rates. Friesland is quoted at 116s per cwt. Irish bacon is rather short of the demand, and prices rule firm. Hams are steady, but on a slow sale, at about late rates. No change in other descriptions.

Spirits.—There is an active demand for rum, and the quotations have an upward tendency. Brandy and gin are unaltered in value.

Hay and Straw.—Meadow hay, £3 15s. to £4 5s.; clover, £3 to £5 15s.; and straw, £1 16s. to £2 3s. per load.

Wool.—The private market is very dull, both for English and colonial wools, and prices are barely supported.

Hops.—Large supplies of the new crop are now on sale, the quality of which is rather variable. For all qualities the demand is heavy and prices tend downwards.

Potatoes.—There are liberal supplies on sale, for which there is a fair trade, at prices varying from 80s. to 130s. per ton.

Coals.—Newcastle, 15s. to 19s. 9d.; Sunderland, 19s. 9d. to 22s.; Hartlepool and West Hartlepool, 21s. to 22s. per ton.

Oils.—Linseed oil sells at £30 on the spot; English brown rape, £38; ditto, refined, £40 to £40 10s.

Tallow.—P.Y.C. is quoted at 43s. 6d. on the spot, and 43s. 9d. for next December; town tallow, 42s. 6d. net cash.

Metropolitan Cattle Market (Thursday, Oct. 3).—Fair average supplies of beasts have been on offer, and for which the demand has ruled very inactive, at barely last week's prices. Best Scots and Herefords have sold at 5s. per 81lb. Sheep—the show of which has been extensive—have met a slow sale, at barely late rates. The top price for choice Downs and half-breds has been 6s. 10d. per 81lb. Calves have been rather scarce, and dearer. Pigs have sold steadily, at late rates. Beef, from 3s. 2d. to 5s.; mutton, 3s. 8d. to 6s. 10d.; veal, 4s. to 5s.; pork, 3s. 4d. to 4s. 2d. per 81lb. to sink the offal.

Newgate and Leadenhall.—There are good supplies of meat on sale, and for which the demand is slow, at our quotations:—Beef, from 3s. 2d. to 4s. 6d.; mutton, 3s. 4d. to 4s. 6d.; veal, 3s. 10d. to 4s. 8d.; pork, 3s. 2d. to 4s. 2d. per 8lb. by the carcass.

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SIR JOHN BROWN,
OF SHEFFIELD.

Sir John Brown, on whom the Queen has lately conferred a knighthood, is chairman of one of the largest establishments in the world, the Atlas Steel, Iron, and Armour-plate Works at Sheffield, covering thirty acres of land, and giving employment to 4000 workmen. His life is a striking example of untiring energy and perseverance. His achievements have been manifold. He began, in 1844, the manufacture of cast steel, and shortly after, in 1847, commenced the spring trade, in which he soon became noted for the invention of the conical spring, now most extensively used on home and foreign railways. In 1855 he introduced into Sheffield the manufacture of bar iron for conversion into steel; and subsequently he made the "Atlas" boiler-plates, which are recognised by her Majesty's Government as equal in quality to those supplied by the Lowmoor and Bowling Companies.

Having followed up his iron operations to so satisfactory a point, he turned his attention to a more important production of steel; and Mr. Bessemer, who was at that time working out his marvellous invention, found him willing to put down the necessary plant to carry out the process on a more extensive scale. After many preliminary trials and experiments, involving great outlay, Sir John Brown had the satisfaction of being the first to turn out Bessemer steel rails and plates, the quality of which has enabled him to hold the highest rank in the trade. At present 700 tons of this metal are made weekly at the Atlas Works, for manufacturing rails, tires, bridge work, shot, and other purposes.

By far the most important service, however, which Sir John Brown has rendered his town and country is the production of armour-plates for the protection of ships and forts. As early as 1858, when it was problematical whether any efficient protection could be given to ships against the improved ordnance of Sir William Armstrong, the engineer for the War Department of rifled ordnance, Sir John Brown succeeded in rolling armour-plates far superior to any that had formerly been made. Up to that period no plates had been rolled thicker than 4½ in.; and, finding these were insufficient to resist the increasingly powerful guns of the day, Sir John volunteered to supply the Admiralty with plates 5½ in., 6½ in., and 7 in. thick; and, notwithstanding the immense strides made in modern ordnance, he has always been able to deliver plates of a proportionate resistance capability, having now rolled them up to 15 in. thick.

In local affairs Sir John Brown stands in the highest esteem, and has successively been elected to all the offices of the borough. He was twice Mayor, and twice Master of the Cutlers' Company, and is now both a borough and county magistrate, besides being one of the Deputy Lieutenants of the West Riding of Yorkshire.

Having in all these various capacities shown the greatest liberality and good spirit, together with a wish to promote the welfare of his workmen, for whose particular use he has erected a church in the neighbourhood of the works, the distinguished honour which he has received from her Majesty the Queen is regarded by his fellow-townsmen as a well-merited reward.

SIR JOHN BROWN, OF SHEFFIELD.

THE EXPEDITION IN SEARCH
OF DR. LIVINGSTONE.

The expedition sent out by the council of the Royal Geographical Society, with the support of her Majesty's Government, to ascertain the fate of Dr. Livingstone, who, in the opinion of Sir Roderick Murchison, may still be alive, is now fairly launched on the waters of the river Zambesi. Its leader is Mr. E. D. Young, an able and energetic warrant officer of the Royal Navy, with whom are associated Mr. Henry Faulkner, a volunteer, and two acclimatised Englishmen, the one a mechanic and the other a seaman. Mr. Young did good service in the last Zambesi expedition in managing the Lady Nyassa river-boat. We have given an Illustration of the portable steel boat, made for this occasion. It is so contrived that it may be taken to pieces and carried by a number of men on land. On July 15 H.M.S. Petrel, Commander Gordon, took on board at Table Bay the steel boat and stores belonging to the searching party. She proceeded the same day to Simon's Bay, to take up Messrs. Young, Faulkner, and the others, after making the necessary preparations for their final departure to the Zambesi. She again weighed anchor, under sail and steam, at nine p.m. on the

PARIS FASHIONS FOR OCTOBER.—SEE PAGE 369.

16th, with a light breeze from the north-west, in the midst of torrents of rain. When she had rounded Cape Hanglip the breeze freshened to ten knots, and the Petrel stopped steaming until within about 500 miles of the Zambesi, when the wind fell light almost to a calm, which was most favourable for putting the steel boat together. This work was commenced on July 23, and completed on the 26th; but, notwithstanding all the care and mechanical skill bestowed upon it, the boat, when hoisted out, leaked considerably, so that she was obliged to be hoisted in at once to make her stanch. This was speedily and satisfactorily accomplished. The boat was again hoisted out on the 27th, and was loaded with stones for the inland voyage of the expedition. Two more boats (whalers) belonging to the expedition were also laden and left the Petrel accompanied by two of her cutters. On parting from the Petrel three hearty cheers were given for the daring little band, and no doubt many a silent prayer was offered for their success. There was no difficulty in crossing the bar of the Zambesi at the Kongoni mouth, the East Luabo mouth having been found impracticable. Mr. Young was fortunately enabled to hire a number of natives, and he intended to start on his search the day he landed. No news could yet be obtained as to the fate of Dr. Livingstone. We have engraved a sketch of the steel boat starting on its voyage up the river Zambesi. It is hoped to carry it across the country to Lake Tanganyika, which lies northward of Lake Nyassa, but is not connected with it. Some geographers have conjectured that Lake Tanganyika may communicate with the Albert Nyanza of Sir Samuel Baker, and so with the Nile. This would be indeed a grand discovery.

THE ABYSSINIAN COAST IN THE RED SEA.

In passing towards the Strait of Bab-el-Mandeb, a glimpse is got of the Abyssinian coast. As those who pass this way are either going to or coming from India or our other Eastern dependencies, this glimpse of the African continent,

Where Lybian monsters yell,

is full of deep and anxious significance. Beyond those mountains, in hunger and chains, captives are held by a veritable "Lybian monster," and the notion arises that such a defiance of our power may raise a doubt in the Eastern mind respecting our invincibility. On this point even a doubt is dangerous. The Eastern bazaar has a strange power of echo; the faintest sound does not loose in passing along, and the fact that "Sahib Log" were in ignominious captivity would be too tempting a tale. It would receive every aspect of wild exaggeration inimical to our interests. Hence the reason of the enthusiasm which we hear of about the expedition among our people in India. The usual traffic on the Red Sea is small. With the exception of the P. and O. steamers, or an occasional dhow bound for Mecca with pilgrims, few are the sails to be seen. But a change will soon come over the Erythræan Sea; our fleet of transports will give a new life to these waters, and by these means the power of Britain will pass over dryshod and in safety; and the fate of the modern Pharaoh is as certain as that of the one of old who oppressed the captives, and would not let them go till the thunders of judgment were upon him.

INDIAN TROOPS FOR ABYSSINIAN SERVICE.

The greater part of the force intended for service in Abyssinia is to be composed of Indian troops; and, according to the accounts published, they are to be Punjaub regiments, organised upon the irregular system. The same kind of force was sent to China; and, as doubts were expressed respecting this kind of organisation, they will be watched by those who are interested, and their faults and failings will, no doubt, be duly noted in the forthcoming operations. As the words "irregular regiment" may not be very clearly understood by most people, a slight description of the difference which exists between them and the regulars may be worth giving.

A regular regiment may consist of about 1000 men, and somewhere about thirty officers. In an Indian regiment these officers would be all European. An irregular regiment does not muster half this number of men, and the European element is reduced to the commanding officers, and perhaps two others and a surgeon. The duties done by captains, lieutenants, and others, are performed by native officers, who bear the title of Resaldár; so that the European officers may be described as equivalent to the field officers of the regular service. The objection urged against this system is the insufficiency of the commanding power—not in quality, for they have as a rule been men of note—but the small number of officers is liable to total extinction, either by an engagement or by disease, and the regiment may be thus rendered useless. This objection assumed shape during the late Bhotan war. Against this argument may be placed the services of such regiments in China, and the brilliant performances which they achieved during the Indian mutiny. In fact, we say that it was the Sikhs who saved India, and they were all upon this irregular plan.

Our Engraving represents the officer in command of an irregular cavalry regiment, and some of his Resaldárs, or native officers, who have come to consult him, perhaps about the orders for the day, or some point of regimental discipline. Three men are shown in the Illustration, one with his boots, fully equipped, ready for mounting; another not exactly in full regimentals; and the third in the usual undress of Sikh soldiers. In the two last the tight trousers of the men are a characteristic feature. A Sikh swell is most particular about his nether garments, and a close fit is indispensable; it is even said that an extreme dandy of the Sikh persuasion has his inexpressibles sewed up after they are on his legs. However thin the muscular development may be, a Sikh prides himself on the great strength of his inferior extremities; and this pride is not without foundation, for they have earned the title of "Iron Legs." The very large "pugree," or turban, is a marked feature of their costume. The soldier walking as sentry wears the costume of all the Punjaub infantry. With the exception of the head-dress, the costume is the same in shape as the British Army; but in colour it is of a dusty grey—almost a moleskin colour. This particular grey is by the natives of India called "Kákkie;" and from this, in addition to their other names, the Punjaub infantry are called "Kakkie Wallahs." The man on the camel is what is called a "Scootar sowar," or camel soldier. They are not used for fighting; but a force such as that destined for Abyssinia would have a number of these men to carry despatches and messages from one camp to the other. They are soldiers, and are well armed, which is necessary for their defence when bearing letters of importance or messages respecting the movements of the army.

Messrs. Mason and Co., photographers, of Old Bond-street, had the honour to take a group photograph of the Bishops attending the Pan-Anglican Synod at Lambeth Palace last week.

Under the provisions of a new postal convention concluded between France and Greece, no more than the British rate of postage on newspapers and other printed papers originating in the United Kingdom, addressed to Greece and intended to be forwarded by French packet, can, after Nov. 1 next, be paid in advance. This postage, which must be paid by means of postage-stamps, is as follows:—For a newspaper, not exceeding 4 oz. in weight, duly registered at the General Post Office for transmission abroad, 1d.; for a packet of printed papers, other than newspapers, not exceeding 4 oz., 3d.; every additional 4 oz., 3d.

Mr. Joseph Sturge questions the accuracy of a statement which has been made in the *Times* that the English graves in the Crimea are neglected. He says—"When travelling in the Crimea in the month of November last I visited a large number of these interesting spots, and they appeared to be, without exception, well looked after, and in a condition which reflects credit on the care of the resident custodian and on the supervision of the Vice-Consul at Theodosia. Among the numerous tombstones in the inclosure on Cathcart's-hill I did not see one which was defaced or damaged." A traveller who was at Sebastopol in August agrees with Mr. Joseph Sturge that the English graveyards have not been so neglected as to bring discredit on us as a nation or to cause pain to those whose affections cling to these last homes of their relations or friends. It is true, he says, that brambles, and creepers, and flowers have twined themselves round many of the stones, but the solemnity of the spot is rather increased by these gifts of nature to the memory of the dead. The only monument which he observed to have been defaced was the one on the plain in front of the Redan; from that the English inscription is cut away.

CHESS.

TO CORRESPONDENTS.

T. C. U. should send his name and address. The examiners pronounce each of his three Problems defective, but would suggest a remedy in the case of two, if they knew how to communicate with the author.

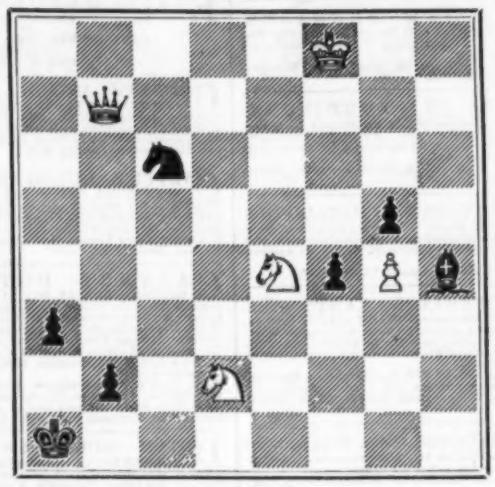
BADEN-BADEN.—Will our correspondent who transmitted an account of Mr. Kolisch's chess *séance* at Baden-Baden be so obliging as to forward the promised games at his earliest convenience? At the present moment, while they are "news," they will be doubly acceptable.

SANDY.—You may be a "constant reader," but, forgive our saying so, you cannot be a very observant one. The second solution of No. 1227 was admitted to be a *bilks vera* in our last Number. Correspondents would do well to bear in mind that when a solution of a problem different to the one published, but yet bearing the appearance of being true, is sent to us, we forward it to the author of the Problem in question. He has then to examine and return it. If he resides in England, this is a work of days; if he lives abroad, it is often a work of weeks. We cannot, therefore, satisfy the impatience of the discoverers, real or supposed, "without fail in the next Number."

PROBLEM NO. 1232.

By Mr. W. GRIMSHAW.

BLACK.



WHITE.

White to play, and mate in three moves.

CHESS IN DUNDEE.

A fine Game played at the Dundee Chess Meeting, between Mr. NEUMANN and Mr. BLACKBURNE.—(*King's Kt's Gambit.*)

BLACK (Mr. N.)	WHITE (Mr. B.)
1. P to K 4th	P to K 4th
2. P to K B 4th	P takes P
3. Kt to K B 3rd	P to K Kt 4th
4. B to Q B 4th	B to K Kt 2nd
5. P to Q 4th	P to Q 3rd
6. Castles	P to K R 3rd
7. P to K Kt 3rd	P to K Kt 5th
8. Kt to K sq	P to K B 6th
9. P to Q B 3rd	Kt to Q 2nd
10. Kt to Q R 3rd	Kt to Q Kt 3rd
11. B to Q Kt 3rd	Q to K 2nd
12. Kt to Q 3rd	B to Q 2nd
13. Kt to K B 4th	P to K R 4th
14. Q to Q 3rd	P to K R 5th

(The counter-attack, of which this is the initiatory movement, is sustained by Mr. Blackburne with remarkable ability. The decision, the vigour, and withal the resource with which it is conducted indicate a consummate capacity for chess combination.)

15. Kt to Q Kt 5th	P takes P
16. P takes P	P to Q B 3rd

(This is very bold, and must have puzzled Mr. Neumann as much as, for a time, it did us. The main object of it, we presume, is to prevent Black from planting a Kt at Q 5th, and for this White determined to sacrifice a Rook and Kt!)

17. Kt to Q B 7th (ch)	K to Q sq
18. Kt takes Q R	Kt to K B 3rd
19. Kt takes Q Kt	Kt takes K P
20. Kt takes B	Kt takes K Kt P
21. Kt to K 6th (ch)	

BLACK (Mr. N.)	WHITE (Mr. B.)
	(Could this Kt have been expended more profitably at K Kt 2nd? The move made shuts out the Queen from the King's file, it is true; but the great desser to guard against is her going to K R 5th presently.)
21.	P takes Kt
22. Q to K Kt 6th	

(Hoping to "pin" the Queen by playing the Bishop to K Kt 5th; but Mr. Neumann overlooked the capital move his adversary had in store.)

22.	R to K R 7th

(Finely played. This effectually frustrates the attack Black meditated on the adverse Queen, and opens for White an easy road to victory.)

23. R takes K B P	

(This was obviously forced.)

23.	P takes R
24. K takes R	

(Here, again, Mr. Neumann had no choice, other than the *instant* loss of his Queen.)

24.	Q to K R 5th (ch)
25. K to Kt sq	Q to R 8th (ch)
26. K to B 2nd	Q to Kt 7th (ch)
27. K to K 3rd	Kt to B 8th (ch)
28. K to B 4th	Q takes Q
29. K takes P	Kt to K R 2d (ch)
30. K to B 2nd	K takes Kt
31. B to K B 4th	Q to K B 4th
32. K to Kt 3rd	Q to Kt 5th (ch)
33. K takes Kt	Q takes B (ch)

And White resigns.

DUNDEE CHESS CONGRESS.

The following was the final score in the chief Tourney at the Dundee chess meeting.

	Won.	Lost.	Drawn.
Blackburne ..	5	3	0
Dr. Fraser ..	2	5	1
G. B. Fraser* ..	2	4	1
Hamel	2	7	0
Macdonnell ..	6	2	1
Neumann ..	7	1	1
Robertson ..	3	6	0
Spens	0	8	1
Steinitz ..	7	2	0
De Vere ..	6	2	1

The first prize was therefore carried off by Mr. Neumann, the second by Mr. Steinitz, and the third was divided between Messrs. De Vere and Macdonnell.

HANDICAP TOURNEY.—In this contest, at the same meeting, the first and second prize were divided between Messrs. Steinitz and Dr. Fraser. The third was won by Mr. Neumann, and the fourth by Mr. P. Scott.

* Mr. G. B. Fraser resigned, without playing, to Mr. Blackburne and Mr. De Vere.

OBITUARY OF EMINENT PERSONS.

THE REV. HENRY BIDDULPH.

The Rev. Henry Biddulph, B.D., Rural Dean, Rector of Birdinbury, Warwickshire, and Standlake, Oxfordshire, who died on the 19th ult., was the youngest son of Sir Theophilus Biddulph, fifth Baronet, of Westcombe, Kent, by his wife, Hannah, daughter of H. Prestidge, Esq.; and was brother of Sir Theophilus Biddulph, the sixth Baronet, and uncle and heir presumptive of Sir Theophilus William Biddulph, the seventh and present Baronet. He was born in 1796, and was educated at Rugby; and he was, previous to his death, frequently spoken of as one of the "oldest living Rugbeians." He was in 1826 appointed Rector of Birdinbury, and in 1832 of Standlake. He was a clergyman well known and greatly esteemed throughout the county of Warwick. He married, July 1, 1834, Emma Susan, only daughter of John Nuttall, Esq., of Worley Bank, Worcester, and leaves an only daughter, Adelaide Emily, who was married, Oct. 26, 1865, to the Rev. Humberston Skipwith, Rector of Hamstall Ridware, Staffordshire, ninth son of the late Sir Gray Skipwith, Baronet, of Prestwould, Leicestershire. The remains of the lamented Mr. Biddulph were interred on the 25th ult. in the family vault at Birdinbury.

HENRY WICKHAM WICKHAM, ESQ., M.P.

Henry Wickham Wickham, Esq., M.P. for Bradford, who died on the 22rd ult., at his house, 12, Clarendon-place, Leamington, was a scion of a family of Wickham claiming to be that of William of Wykeham, and was the eldest son of the Rev. Lamplugh Hird, Prebendary of York and Vicar of Paul, in the East Riding (who changed his paternal surname of Wickham on marrying Sarah Elisabeth, eldest daughter of Richard Hird, Esq., of Rawdon), and was nephew of the Right Hon. William Wickham. He was also a brother of Lumplugh Wickham Wickham, Esq., of Lowmore House, Yorkshire. He was born in 1800, and was educated at Geneva. He resumed his patronymic, Wickham, at his father's death, in 1843. He was a Liberal Conservative, and was first returned for Bradford in 1852, which borough he continued to represent till his death. He was one of the leading partners of the Low Moor Ironworks at Wibsey, near Bradford; and was a Deputy Lieutenant and magistrate for the West Riding of Yorkshire. He was chairman of the West Riding Quarter Sessions and chairman of the Lancashire and Yorkshire Railway Company. Mr. Wickham married, in 1836, Mary, eldest daughter of Thomas Benyon, Esq., of New Grange, near Leeds, which lady died in 1852.

A return has been published from which it appears that the persons employed on Sunday throughout the United Kingdom consist of 31 inspectors, 758 postmasters, 1034 clerks, 877 stampers and sorters, 3762 letter-carriers, 2911 rural messengers, 8852 sub-postmasters or receivers, and 2716 other persons—chiefly mail guards, mail-cart drivers, and assistants at the smaller country offices. There are 554 head offices and 6172 sub-offices open to the public on Sunday in England; 1882 are not open. In Scotland 133 head offices and 1062 sub-offices are open, and 159 are closed. In Ireland 133 head offices and 1452 sub-offices are open, and 40 are closed.

THE WESTMINSTER CHAPTER-HOUSE.

The restoration of the Chapter-house, Westminster Abbey (the interior of which, in its unrestored condition, we have engraved), is being pushed forward, under Mr. G. G. Scott's direction, with energy and success. The effect of the mere clearing away of some of the masses of rubbish which encumbered the windows and other parts of this so long neglected, yet most deeply interesting, historic relic is amazing; its incomparable proportions, at once stately and imposing yet exquisitely light and elegant, are now again apparent; we can now form a far more accurate estimate of the magnificence of its prime, when one of the choicest examples of the best period of Gothic art.

Little surprise can be felt on learning that the work of restoration is attended with unforeseen difficulties and considerable risk. A portion of the building to the south was found to be in a very weak and crumbling condition. To this point, in fact, the whole structure was inclining; the wall shafts here are alarmingly bowed, and the great central pillar is much out of the perpendicular. A system of iron bar supports, radiating from the centre and running round the walls, like a rudimentary spider's web, had originally knit the building together, but these bars are found to have been cut through. Now, as the Chapter-house, when cleared, may be compared to a gigantic octagonal lantern sixty feet in diameter and elevation internally, with great windows occupying by far the larger portion of each face except that blinded by abutting on the Abbey, it follows that the removal of the brickwork which blocked up the windows would leave the building still further in need of support. Accordingly, one of the first steps was to shore up the modern roof and portions of the walls before cutting away the floor of the upper chamber formed under the roof, and clearing the windows. With the same view, early attention was given to the flying buttresses, which were either so dilapidated or filled up and built about as to be scarcely recognisable. Three of these massive buttresses are now restored with new stone from the Chilmark quarries. A fourth is in hand; but, to complete this one in accordance with the others, it would be necessary to reclaim a few feet of space encroached upon by the gymnasium of the Westminster School. Such accordance seems desirable; but, as stability may be secured without it, the right to the space will not be insisted on. It was thought that the buttresses terminated in stumpy gablets; but Mr. Scott has discovered remains which authorise their being crowned with pinnacles.

Like all the shafts and mullions of the interior, the great pillar in the centre, including its clustered shafts, is of Purbeck marble, but had been painted over; the paint will, we need not say, be removed, and the marble polished. The pavement of diverse-patterned encaustic tiles is in wonderful preservation, owing partly to its almost indestructible nature and close, sound cementing, and partly to its having been boarded over (to keep their feet warm) by the guardians of the records kept here from the beginning of last century till lately. That this is the original pavement is evident from the occurrence of the arms of Henry III.; and it is certainly one of the most beautiful examples of Mediæval tiling in Europe. Its colouring is superb, and the conventional flowing patterns are pencilled with charming delicacy. Among the patterns are little figures of kings, queens, ecclesiastics, and minstrels. But, though the custodians of the records preserved the pavement for their own comfort, they did not hesitate to shamefully mutilate the most conspicuous and beautiful portions of the noble structure for a very small convenience. Merely to place the record presses a few inches nearer the wall, they ruthlessly hacked away the capitals and lower portions of the rich label-mouldings of the wall arcade. This mutilation might be restored from the remains with probable accuracy; but we trust nothing of the kind will be attempted. Any new patchings or additions not essentially needed for structural support tend to unnecessarily falsify history and sophisticate art. An irreverent "restorer" is of course anxious only to make a great show of what he has effected; he is ready to satisfy tasteless employers, and to gratify that vulgar portion of the public who must have everything spic-and-span new. But the Chapter-house is not in such hands; and every artistic and thoughtful person will infinitely prefer its touching scars and injuries, or mere fragments from the wreck, if testifying to its former glory, to anything that could possibly be substituted—for most "restorations" amount to that.

In regard, however, to the windows, the case is dissimilar. These, having wholly disappeared (with the exception of an iron framing proving a different mode of glazing to that now in use), must be replaced; and, as recently a few small pieces of glass, of grisaille, ruby, blue, and other colours have been found, the style of the new lights seems to be authorised. The style of the period on the spot is known; it consists of a mosaic of grisaille, with small coloured pieces at rather wide intervals, and small medallions of figures in the upper part of the lights. There is an example of the style in the Jerusalem chamber; and, curiously enough, a portion of a window of about the required date, situated in the apsidal chapel of the abbey, but completely built in by Henry VII.'s chapel and a monument in front, was lately discovered. We may remark, in passing, that this style has been chosen for the memorial window to the late Lord Macaulay, now being erected in the south aisle of the abbey nave near the crossing. Returning to the wall arcade, we have to note in the spandrils the various admirably designed and carved diapers in perfect condition. Here and on other portions of the carvings and walls are abundant remains of intense polychromatic decorations and gilding. Some of the caps here and elsewhere are richly foliated; others are simply moulded; but all are graceful. A great deal of interest attaches to the (once) double portal at the top of the steps of the vestibule, which connects the Chapter-house with the cloisters. The pillar dividing this portal has disappeared, as also the tracery of its head, which once inclosed in a large centre quartrefoil a figure of our Lord. A confirmation of this last fact is furnished in a passage of a curious old document which directs the monks on entering the Chapter-house to kneel to such a statue. In the wall space to right and left of this door-head (which contained the statue of Christ) are two censing figures in trefoils; and in the niches which flank these stand statues of the Virgin and the Angel Gabriel, which, strange to say, have escaped both the Puritans and the record people. The bronze wings of Gabriel have, however, been carried off. All these figures should be regarded as parts of a composition representing the Annunciation. About the jambs and hood of this portal several ranges of very delicate and beautiful carvings, particularly a series of small seated figures crossed by a branch of foliage, have been brought to light on the removal of the vast accumulation of whitewash which happily protected while it concealed them.

The interesting tempera wall paintings around two thirds of the Chapter-house are in partial preservation, and have been protected by a varnish. The principal composition is on the wall spaces or stalls on the eastern, or Abbott's side; and this is a most favourable example of, probably, early fourteenth-century art. The subject is Christ in Majesty, with probably the Archangels Gabriel and Michael, and angels bearing the emblems of his passion, together with the Virgin (?), and apparently, SS. Peter and Paul, and other saints. This picture, which, in the accessorial figures, appears to have been left unfinished, is remarkable for having been, except a few draperies, evidently studied and well advanced in the preparatory painting with minium—a full red which would afford a sound ground on the bare wall. We agree with those who consider this the work of an Italian artist. The sentiment of the expressions, and the technical processes, especially the mode of embossing the crown and other jewelled portions for the reception of "nouches," support this ascription. Next this a group of larger-sized figures, all turned towards the Majesty, and in attitudes of adoration—probably biblical and ecclesiastical worthies—have an almost caricatured individuality in the heads, which point to a somewhat later period. A long series of paintings adjoining, of perhaps earlier date, and even less merit, contain illustrations of the Apocalypse.

Lastly, there is a series of ancient paintings on the wall space which abuts on the abbey, representing animals each with its name inscribed, and subjects elucidated by old Latin legends beneath from one of the apocryphal Gospels.

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CARTER'S GUINEA BOX of DUTCH FLOWER-ROOTS contains 12 choice named Hyacinths, 12 mixed Hyacinths for borders, 50 yellow Crocus, 50 blue Crocus, 4 Polyanthus Narcissus, 12 double white Narcissus, 12 Pheasant's-eye Narcissus, 12 double Daffodils, 24 finest mixed Ranunculus, 24 finest mixed Anemones, 12 choice mixed single Tulips, 12 choice mixed double Tulips, 4 Garden Lilies, 50 Snowdrops, 12 finest mixed Spanish Iris, 12 Campernel Jonquils.
The above forwarded without delay on receipt of Post-office order for 21s.; box and packing included.
Price-lists gratis and post-free on application to Carter's Great London Seed Warehouse, 237 and 238, High Holborn, London, W.C.

DUTCH BULBS for FORCING and CONSERVATORY DECORATION.—The following choice selection sent carriage paid on receipt of Post-office order for 21s.:—12 fine named Hyacinths, 6 named Polyanthus Narcissus, 12 Van Thol Tulips named, 6 Jonquils, 12 Lilium Lancifolium, 6 Ixias, 6 Sparaxis, 6 Babianas, 1 Cyclamen, 3 Amaryllis Formosissima, 50 named Crocus, 3 Scilla siberica, 6 Oxalis speciosa. Half the above for 10s. 6d. Catalogues free. BUTLER, M'CULLOCH, and CO., Covent-garden, London.

PARIS EXHIBITION GOLD MEDALS.
LIEBIG'S EXTRACT OF MEAT (Extractum Carnis, Liebig), manufactured by Liebig's Extract of Meat Company (Limited), 43, Mark-lane, London. Only agent authorised to be called by the above names by Baron Liebig, the Inventor, whose certificate is on every jar. Superior and economical stock for beef-tea, soups, entrees, and sauces. Extremely useful to invalids, persons of weak digestion, and children. Taken with rice, arrowroot, sago, &c., an agreeable and most efficient substitute for cod-liver oil. It keeps for years, and in any climate. Sold by Fortnum, Mason, and Co.; Barclay and Son; Crosse and Blackwell; S. Maw and Son; all Chemists, Italian Warehousemen, Grocers; and Wholesale by the Company.

SAUCE.
LEA and PERRINS' WORCESTERSHIRE SAUCE, pronounced by Connoisseurs to be "The only Good Sauce."
None genuine without name on wrapper, label, bottle, and stopper. Sold by Crosse and Blackwell, Barclay and Sons, and Grocers and Oilmen universally.

ALLSOPP'S PALE and BURTON ALES. The above Ales are now being supplied in the finest condition, in bottles and in casks, by FINDLATER, MACKIE, TODD, and CO., at their new London Bridge Stores, London Bridge, S.E.

WEAK DIGESTION.—Universal Remedy. MORSON'S PEPSINE WINE, LOZENGES, and GLOBULES, in bottles and boxes, from 2s.—Manufactured by T. Morson and Son, Chemists, 31, 33, and 124, Southampton-row, Russell-square, W. Silver Medal, Paris Exhibition, 1867.

CHOCOLAT-MENIER for BREAKFSTA, sold by all respectable Houses.

CHOCOLAT-MENIER for EATING, sold by all respectable Houses.

MENIER'S FRENCH CHOCOLATE defies all honest competition. The healthiest and most delicious ailment for Breakfast. Unadulterated, highly nutritious. Annual consumption exceeds 5,000,000 lb.—Menier, Paris; 23, Henrietta-street, Strand. Sold retail by all respectable houses.

HORNIMAN'S TEAS are Eightpence per lb. CHEAPER. Confectioners are Agents in London; Chemists in every Town. Genuine Packets are signed Horniman and Co., London; Original Importers of the Pure Tea.

INVALIDS AND INFANTS.—NEAVE'S FARINACEOUS FOOD has for many years received the unqualified approval of Drs. Lankester, Hassall, Letheby, Ure, and other eminent medical men, as a highly nutritious and unmedicated diet for Invalids and Children. Sold in tin Canisters, by the leading Chemists and Grocers.
Neave and Co., Manufacturers, Fordingbridge.

ALMOND FLAVOUR.—PRESTON'S ESSENCE of BITTER ALMONDS, free from Prussic Acid. This delicious Essence is the only kind that may be safely used for flavouring Custards, Blancmanges, &c., and all kinds of Pastry. Sold Retail by Chemists, Grocers, &c., in bottles, 6d., 1s., and 1s. 6d. each; Wholesale, PRESTON and SONS, 98, Londenhall-street, E.C. Observe the Trade Mark.

CITY SOAPWORKS, 1851, 1862, 1867. Established 1718.

COMPOSITE HOUSEHOLD SOAP, concentrated and dried by machinery into ½-lb. cakes, each equal to ½-lb. ordinary soap. Sold by all respectable dealers in 1's, boxes. 56 cheats (60 ½-lbs.), with lock and key, carriage paid. Wholesale only at the City Soapworks, Milton-street, London, E.C. See address on each piece.

THE SILVER PRIZE MEDAL has been awarded to the above.—Paris Exhibition, 1867.

FRAGRANT SOAP.
The celebrated "United Service" Tablet is famed for its delightful fragrance and beneficial effect on the skin.
Manufactured by
J. C. and J. FIELD, Patentees of the Self-fitting Candles.
Sold by Chemists, Oil and Italian Warehousemen, and others.
Use no other. See name on each tablet.

PRICE'S SOLIDIFIED GLYCERINE (Patented).—The newest and best TOILET SOAP; wears well, gives a rich and fragrant lather, is entirely free from cocoanut oil or excess of alkali, and contains half its weight of Price's Distilled Glycerine. Sold in 4d. and 6d. tablets.—Price's Patent Candle Company (Limited), Belmont Works, Battersea, S.W.

SELF-FITTING CANDLES of all Sizes, and in various qualities, from 1s. per lb. upwards, may now be had everywhere. Order of your Chemist, Grocer, or Chandler (J. C. and J. FIELD'S Patent). They are Safe, Clean, and Economical, fitting all Candlesticks without either paper or scraping, and burning to the end.

LIKE SPERMACETI in TRANSPARENCY. PRICE'S GOLD MEDAL PALMITINE CANDLES burn brilliantly yet slowly and without the varying light and tendency to tend and to smoke often complained of in even high-priced paraffins.

SAPO CARBONIS DETERGENS, or PURE COAL-TAR SOAP (Registered).
This unrivalled Soap, if constantly used, will produce a healthy appearance to the skin, while at the same time it acts as a preventive of infectious diseases. See medical testimony, "Lancet," &c. To be had, in tablets of 6d. and 1s. each, of all Chemists; and wholesale of W. V. WRIGHT and CO., Manufacturing Chemists, London.

MOURNING.—Messrs. JAY beg to assure their patrons that they have never before been so well supplied with goods for Autumn wear, and from the fact of the entire Stock having been newly purchased directly from the manufacturers at Roubaix, customers will not only have the advantage of selections from an infinite Variety of New Textures, but of purchasing at almost wholesale prices.
THE LONDON GENERAL MOURNING WAREHOUSE,
247, 249, 251, Regent-street.
JAYS'.

AUTUMN TASTE; or, FASHIONS for AUTUMN.—Messrs. JAY have just received from Paris some beautiful specimens of French art and ingenuity, in a variety of Mantles, so diversified in style, texture, and material as almost to constitute a new class in Ladies' costume.
JAYS'
THE LONDON GENERAL MOURNING WAREHOUSE,
247, 249, and 251, Regent-street.

AUTUMN FASHIONS in MILLINERY. Messrs. JAY have received an Importation of the most Elegant MILLINERY, in every class and design, which the authors and patrons of French fashions have produced and accepted for the current season.
JAYS'.
THE LONDON GENERAL MOURNING WAREHOUSE,
247, 249, and 251, Regent-street.

MOURNING.—BLACK SILKS, directly imported from Lyons.—The depressed state of business during the last few months having caused a great reduction in the price of Silk at Lyons, purchasers at the present time have the advantage of buying Black Silks under extraordinary circumstances.
JAYS'.
THE LONDON GENERAL MOURNING WAREHOUSE,
247, 249, and 251, Regent-street.

INEXPENSIVE MOURNING DRESS. Velours de Rouse, in Black, Violet, Slate, and Neutral Tints, for Autumn wear.
JAYS'
Mourning Warehouse, Regent-street.

JANUS CORD, an inexpensive and remarkably good texture for Mourning Wear. Janus Cord is cut from the piece in any required length. Dresses of the same material are also kept made up, and trimmed with Crape for every degree of Mourning, at about 2½ gs. the Dress.—JAYS', THE LONDON GENERAL MOURNING WAREHOUSE, 247, 249, 251, Regent-street.

JANUS CORD.—Ladies who, at this season of the year, choose to wear Black Dresses, will find JANUS CORD, at about Two Guineas the Dress, one of the most economical and best fabrics manufactured for a lady's dress.
JAYS', 247, 249, 251, Regent-street.

UNDATUS CLOTH.—The Novelty of the Season for Morning Dresses.
Patterns free on application.
JAYS'.
247, 249, and 251, Regent-street.

VELVETEEN,—Perfection of finish and brilliancy of colour are the characteristics of the Velveteens now offered by Messrs. JAY. They may be purchased by the yard: but some Velveteen Costumes, designed by the first Parisian artistes, are specially worthy the attention of purchasers of this very fashionable material.
JAYS'.
THE LONDON GENERAL MOURNING WAREHOUSE,
247, 249, and 251, Regent-street.

KING and CO., Silkmercers, &c., 243, Regent-street, are SELLING OFF, during this month, a BANKRUPT'S STOCK of Autumn and Winter Dresses, Cloaks, Mantles, Jackets, &c., at a great reduction in price. Patterns sent to all parts post-free.
Address to King and Co., Regent-street, London.

WINCEYS, 2s. 11d. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

YOKOHAMA SERGES, 12s. 6d. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

CRETON CLOTHS, 10s. 6d. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

YEDDO POPLINS, 12s. 6d. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

JAPANESE SILKS, 15s. 6d. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

PETTICOATS, 3s. 6d. (SILK WARP WINCEYS), at KING'S, 243, Regent-street. Patterns sent post-free.

PETTICOATS, 7s. 6d. (AUSTRALIAN WOOL), at KING'S, 243, Regent-street. Patterns sent post-free.

IRISH POPLINS, £1 15s. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

BLACK SILKS, £1 to £5 the Dress, at KING'S, 243, Regent-street. Patterns sent post-free.

FANCY SILKS, £1 to £5 the Dress, at KING'S, 243, Regent-street. Patterns sent post-free.

PRINTED FLANNELS, 17s. 6d. the DRESSING-GOWN, at KING'S, 243, Regent-street. Patterns sent post-free.

VELVETEENS, £1 1s. the DRESS, at KING'S, 243, Regent-street. Patterns sent post-free.

WATERPROOF MANTLES, 15s. 6d. each, at KING'S, 243, Regent-street. Travelling Mantles, 12s. 6d. each.
King and Co., Regent-street, London.

SANSFLECTUM JUPONS.
The Demi, 2 yards round, 10s. 6d.;
2½ and 3½ yards round, 12s. 6d.
Pompadour Jupons, 25s. No steel used.
"Elegant in form and moderate in proportion."—Le Follet.
ADDLEY BOURNE, 37, Piccadilly.

LADIES' UNDERCLOTHING.
A Treasseau for £20.
Book of Illustrations, containing all the New Designs in Underclothing, including "The Alice," "Favourite," "Milah," "Maude," "Beatrice," "Dagmar," "Princess," and "Belgravia," Night-dresses, &c.; also, Drawings of Crinolines, Under-Vests, Camisoles, and Dressing-Gowns, gratis and post-free.
"The Trousseaux and articles inspected are not only reasonable in price, but excellent in quality, style, and workmanship."—Englishwoman's Domestic Magazine.
Mrs. ADDLEY BOURNE, 37, Piccadilly.

THE CELEBRATED SHREWSBURY WATERPROOF TWEED CLOAKS, JACKETS, and Gentlemen's OVERCOATS. Patterns post-free.
I. B. and W. PHILLIPS, 37, High-street, Shrewsbury.

PATENT KID GLOVES.—WHEELER and CO.'S OWN MAKE, with patent welts, have been celebrated for half a century for elegance of fit and finish, strength and durability. The Ladies' Gloves are delicately perfumed, all colours in stock. Ladies', 4s. 9d.; Gentlemen's, 4s. 9d. Post-free two extra stamps.
A beautiful assortment of Glove Boxes, suitable for presents.
Wheeler and Co., 210, Regent-street, W.; and 75, Poultry, E.C.
Ladies' Paris Kid Gloves, 3s. 6d.; with two buttons, 3s. 9d.
Gentlemen's, 3s.

SHIRTS.—Morning and Evening Shirts of every description, fitting with precision and ease, at moderate prices. Flannel Shirts and Dressing-gowns.
CAFFIN and WATERS, 26, Regent-street London, S.W.

PETER ROBINSON'S

FAMILY MOURNING WAREHOUSE,
256, 258, 260, 262, Regent-street.
Four houses (in one) devoted exclusively to the sale of Mourning.
Experienced Dressmakers and Female Assistants
sent to take Orders within
200 Miles
from London free of any charge.
The most reasonable prices are charged,
and every article warranted.
Illustrations of Mourning Fashions and
Patterns and Estimates free per post.

FOR WIDOWS' WEAR.
Caps, Bonnets, Mantles, and Dresses,
specially prepared of the best and most suitable materials,
and in correct taste, at very reasonable prices,
at PETER ROBINSON'S
Court and Family Mourning Warehouse,
256 to 262, Regent-street, W.

INEXPENSIVE MOURNING, as well
as the Richest Qualities, can be supplied by
PETER ROBINSON,
upon the most advantageous terms to Families.
The Court and Family Mourning Warehouse,
256, 258, 260, 262, Regent-street, London.

SUPERIOR CRAPE.
THE IMPERIAL UNSPOTTING CRAPES
are far richer in appearance and much more durable
than the ordinary makes. These are finished by the Manufacturer
expressly for
PETER ROBINSON'S Court and General Mourning Warehouse,
Regent-street.

As a Guarantee for Wear, the Maker's Name is woven in the Piece.

SUPERIOR BLACK SILKS,
by Tapissier, Bonnet, and other celebrated Makers.
PETER ROBINSON would invite the especial attention of
purchasers to the superior makes and qualities of his
BLACK SILKS,
and the very reasonable prices at which they are sold. He can
supply good useful Black Silks from 1s. to 70s. the Full Dress,
and superior and most enduring qualities from 3½ to 10 gs.
Patterns free.—Address, Peter Robinson, 256, Regent-street.

At PETER ROBINSON'S MOURNING WAREHOUSE, Regent-st.,
SKIRTS for MOURNING Made-up and
Trimmed in Correct Taste to suit any Occasion,
from 1½ guinea to 6 gs.

At PETER ROBINSON'S MOURNING WAREHOUSE, Regent-st.
MANTLES and JACKETS for MOURNING,
in New and Elegant Shapes, Beautifully Trimmed
in "Correct" and best Taste,
from 2 to 10 gs.

At PETER ROBINSON'S MOURNING WAREHOUSE, Regent-st.,
BONNETS for MOURNING. — French
Bonnets in beautiful variety, from 15s. 6d. to 2 gs.

At PETER ROBINSON'S MOURNING WAREHOUSE, Regent-st.,
WATERPROOF TRAVELLING CLOAKS,
from 1 to 3 gs.

THE FASHIONABLE AUTUMN DRESS.
THE NEW BLACK WORSTED POPLIN
(similar in make to the Irish Poplin),
a most serviceable material, and very inexpensive,
from 10s. 6d. to 30s. the Dress. Patterns free.
PETER ROBINSON'S Mourning Warehouse, Regent-street.

NOVELTY.—THE WAVERLEY CLOTH,
in Black, at 37s. 6d. the Dress.
This is the newest and prettiest material for Ladies' Dresses for
the coming Season. Patterns free.
PETER ROBINSON'S Mourning Warehouse, Regent-street.

SUPERIOR BLACK VELVETEENS
by the Yard; or in Costumes made up in Exquisite Taste.
Patterns free.
PETER ROBINSON'S Mourning Warehouse, Regent-street.

SILKS! SILKS! SILKS!
(Patterns post-free.)
JAMES SPENCE and CO.,
76, 77, and 78, St. Paul's-churchyard,
respectfully announce their NEW AUTUMN STOCK ready for
inspection.
The following are specially noted:—viz.,
20 in. wide Black Glacé at 1s., 1s. 11½d., 2s. 6d., 2s. 9d., and 3s. 11d.
per yard;
24 in. wide Black Glacé Silk, 2s. 11½d., 3s. 6d., 3s. 6d., and 3s. 9d. per
yard, upwards.
A large Lot of Black Brocha Silks, 20 in. wide, 2s. 11½d. per yard;
usual price, 3s. 6d.
A large Parcel of Satin Stripes, both sides alike, in all the new
Colours, 20 in. wide, £1 19s. the Dress.

MANTLES, JACKETS, and SHAWLS.
New Black Cloth Jackets for Autumn Wear, from
14s. 9d. to 63s.
Velveteen Jackets in all Colours.
Coburg-shaped Waterproof Mantles, in all the new Shades, from
16s. 9d.
The New "Costume" Waterproof, trimmed with Braid, from 21s.
Silk Velvet Jackets, richly trimmed, from 42s.
Real Sealskin Jackets, from 4½ gs. to 10 gs.
Made-up Dresses in all the Latest Designs.
DRAPERY, RIBBONS & GLOVES, HOSIERY, LACE,
HABERDASHERY, FANCY, &c.
Family and Complimentary Mourning.
JAMES SPENCE and CO.,
Silkmercers, Drapers, &c.,
76, 77, and 78, St. Paul's-churchyard.

NOVELTIES IN SILKS and NEW
MATERIALS for the Autumn.
Patterns free.
A large purchase of rich Gros de Rone, in all the new Colours,
3½ gs. Full Dress of 14 yds.
GRANT and GASK, 58 to 62, Oxford-street;
3 to 6, Wells-street, London.

RICH MOIRE ANTIQUES, in Black,
White, and all the new Colours, at 4½ gs. Full Dress.
Patterns free.
GRANT and GASK, 58 to 62, Oxford-street; 3 to 6, Wells-street.

NEW FANCY SILKS.—An immense
collection, in a variety of new Colours and Patterns.
Black and Gold Bismarck, &c., from 2½ gs. Full Dress of 14 yards.
Patterns free.
GRANT and GASK, 58 to 62, Oxford-street; 3 to 6, Wells-street.

RICH BROCHÉ SILKS, in new Designs,
from 3 gs. Full Dress, Black Ground, with Colours.
Patterns free.
GRANT and GASK, 58 to 62, Oxford-street; 3 to 6, Wells-street.

BLACK SILKS, in the New Shade of
Colour, from 2s. 6d. per yard.
The New Make Black Silk Cashmere de Soie, warranted to wear,
from 2s. 6d. per yard.
Rich Black and White Brocha Silks, 3 gs. Full Dress.
Patterns free.
GRANT and GASK, 58 to 62, Oxford-street; 3 to 6, Wells-street.

NEW DRESS FABRICS
in great Variety and Novelty.
The NEW BIARRITZ CLOTH, from 12s. 6d. the Dress.
A large assortment of ERINGLINE and WOOL REPS, in New
Shades, 25s. 6d. and upwards the Full Dress.
ABERDEEN LINSEYS, SERGES, &c., best quality, at lowest
possible prices.
PATTERNS FORWARDED FREE.
GRANT and GASK, 58 to 62, Oxford-st.; 3 to 6, Wells-st., London.

REAL FUR SEAL JACKETS,
from 5½ gs. each.
Real Fur Seal Jackets, trimmed Grebe, 4½ gs.
Real Astracan Jackets, from 3½ gs. each.
GRANT and GASK, 58 to 62, Oxford-street; 3 to 6, Wells-street.

500 HUDSON'S-BAY SABLE MUFFS, at
2 gs. each.
Grebe and Minever Muffs, 12s. 9d. each.
Best Ermine Muffs, 10s. 6d. each.
Real Sable Muffs and Collars, 1 guinea each.
Chinchilla and all other kinds of best Seasoned Furs, at most
moderate prices.
GRANT and GASK,
58, 59, 60, 61, 62, Oxford-street; 3, 4, and 5, Wells-street, London.

BLACK SILKS.
FANCY SILKS.
FANCY DRESSES.
BAKER and CRISP'S CHEAP SILKS, &c.
Patterns free to
any part of the world.
198, Regent-street.

BAKER and CRISP'S
NEW AUTUMN SILKS, at £1 5s. 6d.
Striped Gros de Napies .. .. 1 15 6 Full Dress.
Satin Stripes .. .. .. 1 19 6 "
Plain Silks .. .. .. 1 19 6 "

NEW JAPANESE SILKS, at £1 9s. 6d.
New Lyons Silks .. .. .. 2 2 Full Dress.
New Brochè Silks .. .. .. 3 3 "
New Plain Silks .. .. .. 3 3 "

BAKER and CRISP'S
NEW BLACK SILKS, at £1 5s. 6d.
Plain Bright Gros .. .. 1 19 6 Full Dress.
Very Rich ditto .. .. 2 2 0 "
Cable Cord ditto .. .. 1 19 6 "
Figured Lyons ditto .. .. 1 19 6 "
Patterns free.

BAKER and CRISP'S
NEW VELVETEENS, at £1 15s.
New Velveteens .. .. 2s. 11½d. the yard.
New Lyons ditto .. .. 3 gs. the Dress.
Patterns free.

BAKER and CRISP'S
NEW AUTUMN SERGES, at 7s. 6d.
New Wool Serges .. .. .. 10 6 Full Dress.
New Wool Serges .. .. .. 14 6 "
New Wool Serges .. .. .. 19 6 "
New Wool Serges .. .. .. 25 6 "
New Wool Serges .. .. .. 25 6 "
Patterns free.

NEW AUTUMN DRESSES, at 2s. 11d.
New Autumn Linseys .. .. 2 11 Full Dress.
New Autumn Reps .. .. .. 10 6 "
New Autumn Cords .. .. .. 15 6 "
New Autumn Poplins .. .. .. 6 6 "
New Autumn Poplins .. .. .. 10 6 "
BAKER and CRISP.

BAKER and CRISP'S
NEW EPANGLE DE ROUBAIX, at 19s. 6d.
Ditto, ditto .. .. .. 25 6 Full Dress.
Ditto, ditto .. .. .. 35 0 "
French Merinos .. .. .. 15 6 "
French Merinos .. .. .. 21 0 "

BAKER and CRISP'S
NEW WATERPROOF CLOAKS, at 12s. 6d.
New Waterproof Cloaks, 12s. 6d. to 21s.
New Velveteen Jackets, 12s. 6d. to 21s.
New Velveteen Suits, 2 gs. to 3 gs.

BAKER and CRISP'S
MUSLINS for Evening Dresses, 2s. 11d.
Grenadines ditto, 6s. 9d. Full Dress.
Gauzes, Barèges, Balzarines, and
Tarletans, 5s. 6d. Full Dress.

NOTICE.—BAKER and CRISP'S,
at our Depôt House for SILKS, Dresses, &c.
Patterns post-free.
198, Regent-street, London.

SHILLING GLOVES.—BAKER and
CRISP. Any size or colour
for 14 stamps.
198, Regent-street.

HAIR NETS, 12 for 1s.
Every description of Hair Nets.
Post-free for stamps.
BAKER and CRISP, 198, Regent-street.

RICH FANCY SILKS,
from £3 15s. 6d. to 4 gs.
Coloured and Black Grounds.
JOHN HARVEY and SON, 69, Ludgate-hill.

WOOL SERGES.—Patterns Free.
All-wool Coloured Serges, 1s. 2½d. yd., 30 in. wide.
A good and durable fabric.
JOHN HARVEY and SON, 69, Ludgate-hill.

COLOURED SERGE COSTUMES.
Different prices, from 7½s. 6d. to 50s.
JOHN HARVEY and SON, 69, Ludgate-hill.

WOOL POPLINS AND AUTUMN
FABRICS. All Colours.
Poplins, 1s. 11½d. yard. Fabrics, from 1s. 6½d. yard.
JOHN HARVEY and SON, 69, Ludgate-hill.

JAPANESE SILKS EXTRAORDINARY.
CHAS. AMOTT and CO. will SELL, Next Week,
3000 Rich Japanese Silk Dresses,
originally 1½ guinea, for 12s. 9d.
1700 Rich Japanese Silks,
originally 2 gs., for £1 2s. 6d.
2200 Rich Figured Japanese Silks,
worth 2½ gs., for £1 4s. 6d.
3600 Japanese Silks (the very best),
worth 3 gs., for £1 15s. 6d.
Patterns post-free.
61 and 62, St. Paul's, London.

NEW AUTUMN SILKS.
1000 Pieces of Fancy Silks,
1 guinea to 5 gs.
BLACK SILKS AND GROS GRAINS,
worth 2s., for 1s. 11½d.
1500 yards, originally 3s. 11d., for 2s. 9d.
1000 yards, worth 5s. 6d., for 3s. 11d.
5000 yards Fancy Silks, all at
£1 1s., £1 5s. 6d., 1½ guinea;
worth from 2 to 3 gs.
Rich Moire Antiques, all Silk,
worth 4½ gs., for £2 18s. 6d.
Patterns post-free.
CHAS. AMOTT and CO., 61 and 62, Saint Paul's, London.

NEW AUTUMN SILKS and FANCY
DRESSES.—Black and Fancy Silks, £1 12s. to 5 gs.; Irish
Poplins, 2 gs. Full Robes, Corded Silk and Wool Reps, in Plain,
Chints Embroidered, and Stripes, Croton Cloth, 8s. 9d. 12 yards.
Mourning of every description. Patterns post-free. JACKETS
and MANTLES, latest Paris styles in a choice collection of new
materials, at very moderate prices.
CATER and CO., 1, 2, 3, 4, Finsbury-place North;
88, 91, Chiswell-street, Finsbury-square, E.C.

MESSRS. SWAN and EDGAR are now
showing their NEW GOODS, in every department
for Autumn and Winter wear. Their fashions in Costumes,
Mantles, Jackets, &c., for the approaching Season include a
greater amount of novelty of design than on any former occasion.
A visit to their Show-rooms is respectfully solicited.
9 to 11, Piccadilly; and 59 to 65, Regent-street.

THE PATENT SELF-REGULATING
NON-CONSTRICTING CORSET,
designed for the preservation of health and the development
of a perfect figure, supplies the long-felt desideratum—efficient
support, without constriction.

THE PATENT SELF-REGULATING
NON-CONSTRICTING CORSET
is highly recommended by the most eminent Physicians
and Surgeons as an excellent hygienic invention, and largely
patronised by the Ladies of their Families.

THE PATENT SELF-REGULATING
NON-CONSTRICTING CORSET
is emphatically pronounced by every lady who wears it
to be the most comfortable and the most accurately-fitting Corset
ever produced.

THE PATENT SELF-REGULATING
NON-CONSTRICTING CORSET
is acknowledged by the élite of the ladies of England to be
unrivalled for the elegance of its shape and the artistic taste dis-
played in its manufacture.

THE PATENT SELF-REGULATING
NON-CONSTRICTING CORSET.
Ladies residing in the country can rely upon being per-
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REPORTS ON THE CLASSES.

PREPARED BY ORDER OF THE COMMITTEE OF COUNCIL ON EDUCATION.

CIVIL ENGINEERING, PUBLIC WORKS, AND ARCHITECTURE.—CLASS 65.

BY CAPTAIN PONSONBY COX, R.E.

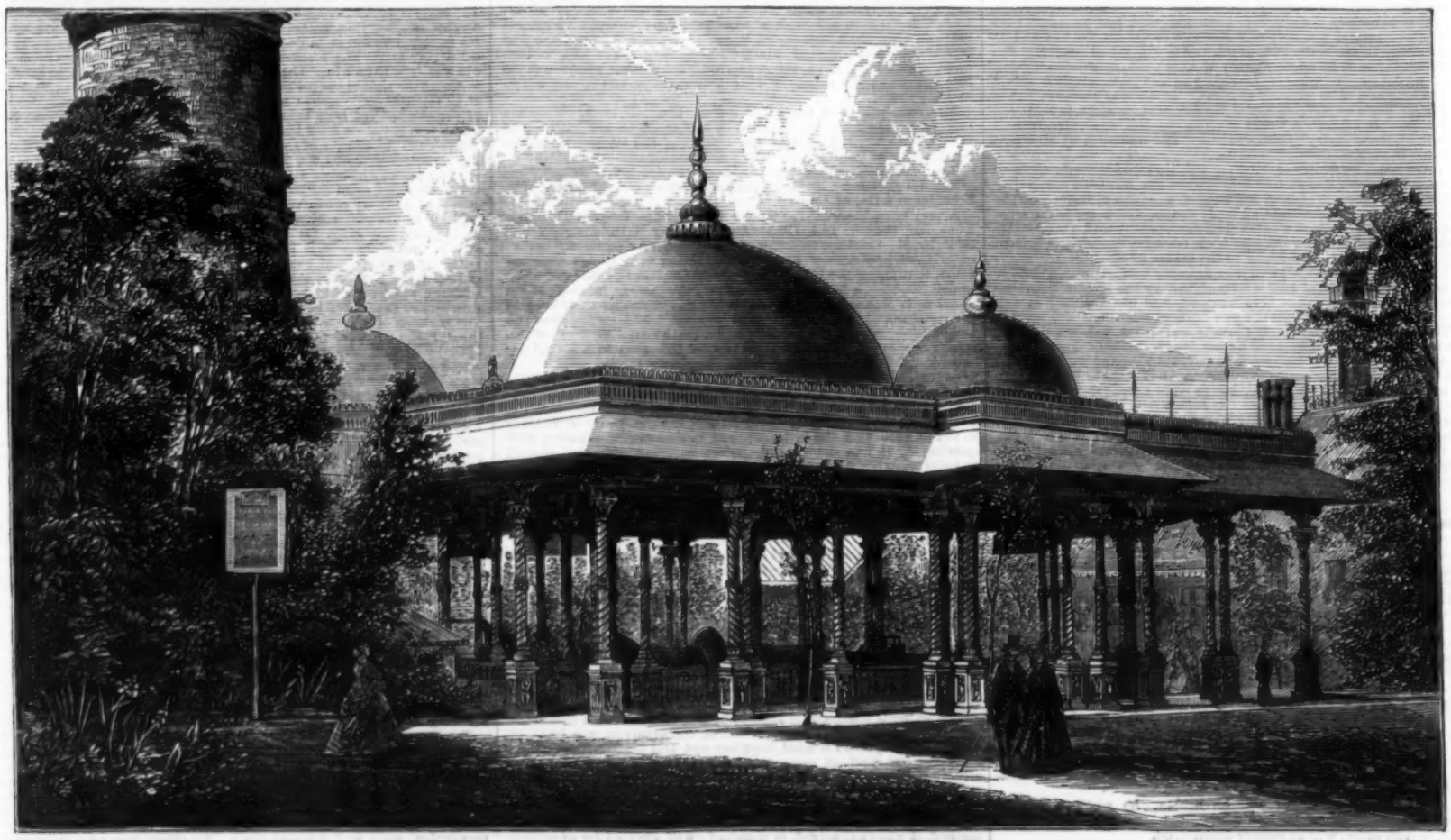
ALTHOUGH there is no science which has given to the world such important practical results within the last few years as that of civil engineering, and though there is probably none which has made more real scientific progress, its recent progress and its later results are far from being adequately represented in the Exhibition of 1867.

In the French section only is there a satisfactory exhibition in civil engineering proper; the other European nations, as well as the United States of America, are but slightly represented. Our own country can hardly be said to be represented at all.

This is much to be regretted, for undoubtedly a well-assorted collection of models or drawings of the most important engineering works scattered all over the world which are due to the energy and skill displayed by English engineers within the last few years, would, if placed side by side with the magnificent collection of models and plans in the French section, have formed an exhibition most interesting and instructive, would have added much to the available knowledge of civil engineering of the world, and saved much of the labour thrown away in re-inventing. From this point of view, the Paris Exhibition cannot but be looked upon as a great opportunity lost. The public works of London alone might have supplied admirable examples in the great railway stations and river bridges recently constructed, as well as the works connected with the main drainage and the Thames embankment. The materials for a good display exist no doubt in the works of Great Britain and her colonies, but we do not possess (nor does any other nation possess), for tabulating those materials, such a machinery as France has in her establishment "des Ponts et Chaussées," her "Ecole des Mines," "des Arts et Métiers," &c.

The French collection is unrivalled. It contains models, admirably got up, of bridges, viaducts, reservoirs, docks, tunnels, &c., with complete plans illustrative of all recent public works; a brief but clear report of each work is to be found in a volume published under the auspices of the Ministère d'Agriculture, du Commerce, et des Travaux Publics. From this source have been derived the figures which will be found in the short notice of some of the most important public works attached to this memorandum.

Leaving France for the present, we find the most important exhibit connected with civil engineering in the English section to be the application to lighthouses of the dioptric system of light of Augustin Fresnel, which system is now being generally introduced, both for fixed and revolving lights. The Trinity House and the Commission of Northern Lights have sent a series of models of lighthouses, light-ships, &c., and several lanterns of different sorts and sizes. These lanterns are all from the works of Messrs. Chance, of Birmingham, and comprise the improvements made by them as well as by Mr. Douglas for the Trinity House and Messrs. Stevenson for the northern lights. The dioptric system has been recently admirably described by Mr. Chance in a paper read at the Institution of Civil Engineers. It consists of a structure of segments of glass enveloping a central flame whose focal rays are parallelised in a horizontal direction and deflected in the case of fixed lights in meridian planes only, whilst in revolving lights the rays are gathered into a number of cylindrical beams which are made to pass successively before the observer by the rotation of the apparatus. The dioptric instrument is further described to consist of three main divisions; an equatorial belt of the sphere of light proceeding from the flame is acted upon by refraction, but the rays above and below this belt are deflected by total reflection; the relative illuminating values in the horizontal plane of these divisions of the part of the



THE BRITISH BOILER-HOUSE IN THE PARK OF THE PARIS EXHIBITION (CLASS 65).—SEE PAGE 375.

luminous sphere acted upon are in the proportion of, upper reflectors, 20; refracting portion, 70; lower reflectors, 10.

It is most important to send towards the sea horizon the brightest sections of the flame. The Trinity House Corporation exhibits the application of the magneto-electric light, for the discovery of which the world is indebted to Professors Faraday and Holmes; the former discovered in 1831 that a spark could be produced by magneto-electricity; the latter, that by this means a continuous flame could be kept up. In 1857 the discovery of Professor Holmes was first applied in the South Foreland Lighthouse. It has since that date been submitted to long practical trial, the result of which has been the determination to adopt it in other lighthouse stations.

The machine for the production of the light consists essentially of six brass wheels, with sixteen bobbins of insulated copper attached at equal distances to the circumferences of each wheel; inside each bobbin is a hollow core of soft iron; the wheels are all fixed upon a shaft, which is driven by a steam-engine. In turning, every core of each wheel is brought at the same instant between the opposite poles of two magnets, which pair of poles it also quits at the same instant. The core of every bobbin has its magnetism thus reversed by the revolution of the wheels 107 times per second. This reversing of the magnetism induces a current of electricity in the bobbins; the combination of the currents produces one of sufficient intensity to give a powerful light. The lantern in which the electric light is used was designed by Messrs. Chance, by whose arrangement the bars of the lanterns are fixed obliquely, and by this means the amount of light stopped by the lantern is reduced to a minimum.

The above appear to be the most striking exhibits in the English section; and, indeed, there is little else calling for special notice in engineering, properly so called. Mr. H. Cole has sent a specimen of enamelled ceiling which in many cases might be adopted with advantage; and the exhibits of ornamental tiles by Minton and Mawe, and of terra-cotta by Blanchard, Blashfield, and Pulham, are prominent instances of improvement in materials of construction.

Messrs. G. Smith and Co. exhibit a specimen of the façade of the South Kensington Museum, showing an admirable combination of finished brickwork with terra-cotta mouldings and enrichments.

Turning to Belgium, we find in an annexe a model of the system adopted by M. E. Boucqueau in the construction of a tunnel on the line of railway from Brain le Comte to Gand. The tunnel, which is about 440 yards long, is carried through a hill on the bank of the River Dendre. It is approached on the north side through a considerable cutting, and the line at the south side is carried on an embankment. It was necessary, in order that the work should proceed with rapidity, that the tunnel should be attacked at several points at once. Sinking shafts from the ground above and lifting the stuff over the hill would have been attended with considerable expense. M. Boucqueau consequently determined to drive in a small gallery, parallel to the tunnel, at one side of it and about 2 ft. below its general level. From this gallery adits were driven right and left at right angles to the axis of the tunnel. The whole of the *deblai* was taken out through these adits and disposed of at the south or embankment side of the hill; whilst the small gallery, being somewhat below the proposed level of the permanent way in the tunnel, kept the workings free from water. The gallery was 5 ft. wide by 6 ft. high. Its sides and ceiling were supported with sheet piling and lagging. The distance between the axes of the small gallery and the tunnel was 57 ft.; the branch adits were about 70 to 80 yards apart. A tramway was laid along the gallery, with turn-tables for the earth-waggons at the mouth of each adit. This system claims to have effected a considerable saving in time and money as compared with the plan of sinking shafts from the top; but it is probably only of exceptional applicability, as in most cases the ordinary system of working from a heading within the line of the tunnel itself would be less expensive.

Prussia exhibits a system of centering lately used in tunnelling, the essential feature of which is the substitution of a portable iron framework for the ordinary timber centering.

This system has been adopted in the construction of the tunnels of Narusen and Ippensen. The mode of employing it will be readily understood from the Illustrations on page 376. A framework consisting of cast-iron segments bolted together (fig. 1) supports a second iron framing, which latter is formed of railway metals, bent to the form shown (fig. 2), and fitted together with radiating joints, like the voussoirs of an arch. These two frames form the principals of the centering. The upper voussoirs are attached to the lower frame by clips, which overlap the lower flange of the railway metals of which they are formed (vide fig. 2). The voussoirs can be removed one by one as the masonry of the arch is brought up to replace them.

From the soffet of the iron principals are suspended hanging pieces, also of railway iron, which support cross bearers carrying tramroads in two or three tiers, as may be necessary, to remove the excavations and to supply the materials of construction.

The advantages claimed for the system are that, from the interior space being not hampered by uprights to carry the principals, as would be necessary if wood were used, the work can be carried on with much greater facility; it is easier to range out the line and to work truly, to ventilate the tunnel, and to get rid of water. The first cost is stated to be very little, if at all, above wooden centerings; and, from the greater durability of the materials, it is stated in the long run to be more economical. It is open, however, to the objection that unequal pressure of the surrounding earth, if sufficient to fracture the centering, would produce much more serious damage than with the ordinary systems in use. The design is by M. Franz Raiba.

In the southern States of Germany a remarkable example of cheap railway-bridge construction is exhibited in the Bavarian section, by a model, on a scale of 1-30th full size, of a bridge of boats over the Rhine, between Maximilians-au and Maxau, which carries a loop-line of the Carlsruhe and Winden Railway, opening up a considerable local traffic, and carrying the coal trade between Bavaria and Baden. The main line crosses the Rhine at the bridge of Kehl.

The road traffic at this point was formerly carried over a bridge of boats, situated about half a mile higher up the stream than the present one; this has since been removed, and the ordinary as well as the railway traffic crosses the new bridge.

The Rhine at Maxau is 240 metres wide; its bed, which is of gravel, is constantly influenced by the deposit brought down by the current, the navigable channel being thereby shifted alternately to the Bavarian and Baden bank. This cause has made it necessary to make two parts of the bridge, one on each side, movable, to allow the passage of the river traffic. The bridge is at right angles to the stream; its length over all is 362·80 metres, of which 234 metres is actual bridge, the ramps of approach from each shore being 64·10 metres in length. These ramps are supported upon timber stages, and their gradient can be regulated by a system of screw gear to suit the level of the stream. The recorded readings of the Rhinometer at Maxau show the extreme range of variation of water level to be 5·10 metres—i.e., between 3·60 above and 1·60 metres below the zero of the scale. These extremes have, however, been but rarely reached; the mean level of the Rhine is 2·50 metres on the scale, and this height of water gives an ascending gradient of 1 in 60 to the approaches to the bridge; the extreme reading of 3·60 metres on the scale giving a gradient of 1 in 30.

The bridge consists of twelve rafts, six of which are easily removable to allow the passage of boats; these rafts are carried by thirty-four pontoons, or boats substantially built of oak, of which material are also the principal beams and the upper planking of the roadway. These pontoons are 65 ft. 6 in. long, 12 ft. 2 in. broad, and 4 ft. 7 in. deep; except the two pair next the shore, which are somewhat larger.

In order to allow the permanent way to adapt itself to the rise and fall of the water level, as well as to the deflection of the roadway from the immersion of the pontoons, on first taking the weight of the train as it leaves terra firma; the joints of the longitudinals and the metals which they carry are made with a hinge where their shore end and bridge end abut, besides which these ends are each borne upon a strong coach-spring.

The general arrangement of the bridge, the position of the movable rafts, and the method adopted of attaching the various parts to each other, will be readily understood.

This bridge was designed by M. Basler, engineer in chief of the railways of the Palatinate. The total cost of its construction was £12,000.

In the Italian section is an atlas containing plans and sections of the great tunnel of Mont Cenis, which is being constructed, as is well known, to unite the Paris-Lyons and Mediterranean Railway with the Italian railways, so as to establish communication with an unbroken gauge between Calais and Brindisi, a distance of 1330 miles, and to annihilate the danger and difficulties of crossing the Alps; which will, however, be much reduced, long before the completion of the greater work, by Mr. Fell's summit railway. The entrance on the French side, about 1¼ mile from Modane, is 439 ft. lower than the Italian end at Bardonnèche; this would give a gradient in the whole length of the tunnel (7 miles 1007 yards) of 1 in 91 nearly. The tunnel is not, however, being executed at a uniform gradient; a fall is given towards both ends from the centre of 1 in 2000 and 1 in 45 respectively. The works, which were commenced in 1857, were first carried on by manual labour. During 1858, 844 ft. were thus driven at the Bardonnèche end; this was the greatest progress which has been made by manual labour in one year. The works are now being carried on with boring machinery driven by compressed air, motive power being obtained by water at the French side from the River Arc, at the Italian side from the River Mezelet, from which sources the water is led to reservoirs. Since the adoption of machinery, the progress has been much more rapid. In 1865, the length driven amounted to 2502 ft. on the Italian side.

Commencing from the French end, the first 2350 yards have been through schist; then 550 yards of quartz were encountered, through which the progress was very slow. This has been cut through, and the tunnel on the French side is now through limestone, which is not quite so difficult as the quartz. The present progress through the limestone is about 1 yard per day; through the quartz it hardly reached 2 ft. After passing the limestone, schist is again reached, which formation extends to the Italian end. It is now stated that the probable date at which the excavation will meet will be some time in 1873.

The public works recently executed by the Italian Government are also shown in an atlas of plans; but they are principally military barracks, and do not appear to be very important or to possess much general interest.

The most important work of civil engineering shown by Spain is the breakwater of Tarragona, of which there is a sectional model.

This work, which is still in progress, can lay claim to priority in point of age to any work of civil engineering in the Exhibition, its commencement dates as far back as 1790.

It is intended, when finished, to be about 1500 yards long, with a total width at top of 100 yards, including a pier on the inner side of 65 yards wide; the base of the breakwater is nearly 300 yards wide. It is formed of pierre perdu. Some of the blocks in the base are of enormous size; their interstices are filled in with smaller blocks; the top stratum is of concrete up to the level of the pier. The work has been carried out principally by convict labour.

It is in the French section, as has been already stated, that we find by far the most important exhibition of works of civil engineering. France undertakes to tell us what her engineers have been doing during the last few years; she shows immense progress in the science. A careful study of the admirable collection of models and plans exhibited by the Public Works department cannot fail to produce the conviction that the works they represent have been most scientifically designed, and executed with great care, great practical skill, and economy. A very slight description is given of a few of the most remarkable of these works. The first selected for notice is the great swing bridge of Brest, which spans the inlet of Penfield between the towns of Brest and Recouviance. Two models—one on a scale 1-50th full size of the whole bridge, another, 1-10th full size of one of the piers—exhibit the construction. This bridge has a greater span than any bridge of similar construction in the world; it is well and solidly constructed, and has stood the wear and tear of ten years without any considerable repair.

The distance between the sea-face walls of the Penfield (571 ft.) is spanned by two wrought-iron lattice frames, revolving upon turntables which crown two circular towers, 34 ft. 9 in. in diameter and 347 ft. apart in the clear: the latter dimension is the total width of the fair way of this part of the naval harbour. Each of these two frames consists of two girders, 25 ft. 4 in. deep over the piers, and 4 ft. 7 in. deep at the centre; these are strongly braced together with perpendicular and diagonal braces, and support the roadway, which is itself constructed so as to add considerably to the rigidity of the structure.

The shore ends of the frames form a rectangular box, which contains the counterweights of the bridge. The total weight borne upon each pier is 590 tons; the turn-table on the summit of each pier is 29 ft. 6 in. in diameter, and has fifty rollers, each 1 ft. 7 in. in diameter and 1 ft. 11 in. in length. The means of opening and closing the bridge is extremely simple; it consists of a pinion fixed to the revolving part of the bridge, gearing into a horizontal cog-wheel on the pier. The motion is transmitted by an intermediate to an upright shaft, which comes up through the roadway of the bridge, and is crowned with a capstan. Four men with capstan-bars can open the bridge in ten minutes. Should it be necessary to repair or replace any of the trucks, or any other part of the mechanism of rotation, the whole weight of the bridge can be lifted off its bed by means of four hydraulic presses in the centre of the piers.

The foundations of the piers are on the solid rock. They are built of rubble masonry, faced with ashlar. The sea walls are of rubble, with dressed quoins; the weight of the metal used in the construction of the bridge is 1180 tons.

The total cost, including foundations, was £85,000.

The design was by M. Oudry; the works were carried out by MM. Schnider and Co., of Creusot.

A very remarkable exhibit by the Ministère des Travaux Publics is a model (1-25th full size) of a masonry arch designed and built by M. Vaudray, engineer of the Ponts et Chaussées," as an experiment preliminary to the construction of a bridge over the Seine, to connect the Rue du Louvre and the Rue de Rennes. The bridge in question had to span the river exactly over the locks of the Canal de la Monnaie; and the necessity, on the one hand, of keeping the springing of the arch above the lock walls, and, on the other, of keeping the level of the roadway down to the existing level of the streets leading to it, confined the rise of the arch to a height not exceeding 7 ft., whilst its span had to be nearly 125 ft.

In order that the new bridge should be in keeping with the numerous important public buildings in its vicinity—viz., the Pont Neuf, the Louvre, the Hôtel de la Monnaie, &c., it was very much to be desired that it should be of stone; and, the possibility of building so flat an arch with the span required in that material having been questioned, it was determined, before carrying out the project, to build an experimental arch which should fulfil the required conditions. The spot selected for the experiment was the quarry of the plains at Soupes, sixty miles from Paris, on the Bourbonnais Railway. The natural quarry face of the rock was shaped to form one abutment, the other was a massive block of masonry built for the purpose.

The description and general dimensions of the arch are as follow:—Its form is a segment of a circle, of which the chord is 124 ft., the versed sine 6 ft. 11 in. It is built entirely of cut stone; the number of the voussoirs in each ring is seventy-seven, diminishing in depth from 3 ft. 7 in. at the springing to 2 ft. 8 in. at the keystone; the beds and joints of the voussoirs are dressed with the greatest care, and are laid in Portland cement mortar, the composition of which is two parts sand to one part cement. The thickness allowed to the mortar joints was ¾ in. The joints next the skewback were not flushed until after the completion of the ring, having been mean time kept open with fir wedges.

The artificial abutment is 27 ft. in height, 49 ft. in mean thickness, and 12 ft. wide (this is also the width of the arch); it was built of rubble masonry, well bonded together and laid in Portland cement mortar—one part of cement to three parts of sand; its construction occupied twenty days, the laying of the voussoirs seventeen days.

The arrangement for striking the centering was by the means of dry sand contained in iron cylinders, hereafter described. This method, it will be observed, is peculiarly well adapted for so critical an experiment as the one under notice. Arrangements were made to observe with the greatest exactitude the effect which should be produced on the arch by the removal of the centering. The arch was left to set four months; the centering was then eased by allowing the sand to flow regularly from the cylinders. In an hour daylight was perceptible between the soffit of the keystone and the lagging; in two hours the arch and the centering were quite separate. The result upon the arch was then found to be as follows:—

The crown had come down 6-10ths of an inch, the joints of the skewback had opened on the built abutment side 7-1000ths of an side. After the lapse of three days the arch was observed to have come down 7-100ths of an inch more.

It was then loaded with a weight of 360 tons, disposed over the whole surface of the roadway; the loading occupied thirteen days. When complete the crown was found to have come down 8-10ths of an inch.

Since then nothing has stirred. The arch was afterwards tested by a weight of five tons being allowed to fall on the roadway vertically over the keystone from a height of 1 ft. 6 in., but no joint has opened, nor has the bridge sustained the slightest injury.

This interesting experiment satisfactorily proves that the relative proportions of rise to span in large masonry arches to which engineers have hitherto limited themselves may be largely modified; it is quite clear, however, that such constructions require very accurate work and the greatest care in execution.

Allusion has been made above to a method of easing and striking centering by means of sand. A full-size model in the park shows this method, now frequently adopted by French engineers for easing large centerings from arches on completion of works—viz., by resting the principals of the centering upon sand contained in iron cylinders, from the bottom of which the sand is allowed slowly to escape.

Each principal is supported upon round props (*a*, *a*, fig. 1), fitting as a piston into a cylinder, containing fine *dry* sand.

The cylinders are of sheet iron, one thirty-second of an inch thick, one foot high, and one foot in diameter. About two inches from the bottom they are pierced with holes about three-quarters of an inch in diameter, which are stopped with common corks. To ease the centering the corks are removed, the sand then escapes through the holes, until a cone of sand is formed at the base of the cylinder. The formation of this cone arrests the further escape of the sand, and therefore the descent of the piston, until the cone is swept away, when it re-forms. The sweeping is repeated until the piston has descended sufficiently to detach the centering from the masonry.

By taking care to sweep away the same cones simultaneously, the lowering of the centering can be performed with perfect evenness, and as gradually as may be desired, by one millionth of an inch, if necessary; whilst, as no force whatever is required to be used, the arch is not subjected to the slightest shock during the operation. This system was originated by M. Beaudemoulin, engineer in chief. It has been applied to many important works; amongst others, to the fine bridge of Austerlitz.

Three fine examples of engineering are exhibited in models, one twenty-fifth full size, of the three iron railway viaducts of Busseau d'Ahun, la Cere, and Du Midi; they are all three of the same type. One of them is the viaduct of Busseau d'Ahun, which carries the Chemin de Fer d'Orleans between Montlaçon and Limoges across the River Creuse, close to the junction of Busseau d'Ahun.

It is composed of a lattice girder in six spans, supported upon iron columns, surmounted upon masonry bases.

Each of the five piers consists of eight hollow cast-iron columns, in two rows of four (transversely to the roadway), cross-braced horizontally and diagonally with rolled iron joists; these piers support four main lattice girders, connected by cross girders, bearing a timber floor and continuous sleepers.

The eight columns of each pier batter towards a point 148 ft. above the roadway, thus forming a four-sided truncated pyramid; the same batter is given to the masonry bases upon which they are mounted; this arrangement gives a very pleasing effect to the structure. The bases are rectangular blocks of ashlar, with dressed quoins carried up from the rock; the iron superstructure is secured to them by eight holding-down bolts of 3½ in. diameter round iron.

The work of erecting this viaduct was performed with great skill; the main girders were riveted together on the bank, and launched into place without the use of scaffolding; this was effected under the direction of M. Moreaux. The design of the viaduct is due to M. Nordling. Its total cost was £60,000 sterling.

The fine and well-proportioned iron lighthouse in the park has been constructed by M. Rigolet, of Paris, from the design of M. Reynaud, Inspecteur Général des Ponts et Chaussées. It is destined for the rocks called "Les Douvres," situated midway between the islands of Guernsey and Brehat, off the coast of Brittany.

The rock on which this lighthouse is to be built is in the middle of the south edge of the shoal; its summit is awash at high tide. The masonry foundations of the lighthouse are 6 ft. 10 in. high; the height of the iron column is, from base to floor of gallery, 158 ft. 6 in.; to top of lantern, 184 ft. 2 in. In plan it is a sixteen-sided polygon. The diameter of inscribed circle at base is 36 ft. 6 in.; at top, 13 ft. 2 in. The light is 174 ft. above high-water level.

Round the base of the column are the store-rooms and living-rooms of the lighthouse-keepers; above these are rooms for the reception of persons rescued from shipwreck. In the centre of the column is a cast-iron staircase from the base to the lantern.

The chief peculiarity of the construction of this lighthouse is that the structure depends for its strength wholly upon its skeleton; the iron plates which are attached to it are merely a skin, and are not at all relied upon for strength; whereas in wrought-iron lighthouses of ordinary construction strength is obtained by the riveting together of the plates of which it is composed. The reasons which M. Reynaud has given for this departure from usual construction are—1, that plate iron is liable to rapid decay from oxydisation; 2, the ordinary mode of construction necessitates special appliances and scaffolding, &c., not easy to erect upon a rock situated as is the Douvres, whereas he has been enabled to arrange the parts of his structure so that it can be put together on the site with great facility. The skeleton of the structure consists of sixteen frames, forming the sides of the polygon, fifteen panels high. Each panel is formed of 7¾ in. by 3½ in. T iron, securely riveted together. These panels are bolted each over each, and strengthened at their edges by a binding piece of 7 in. by 3½ in. T iron bent to the shape of the polygon. The skin is ⅜ in. plate iron at the base, diminishing to ¼ in. at the summit of the column. The joints of the plates are overlapped with stripe of ½ in. iron. The balcony of the lantern is carried upon cast-iron cantilevers. The light is dioptric, revolving upon ten steel friction rollers upon a hardened steel tread plate. The supply of oil is regulated by clockwork, manufactured by M. Lepaute, of Paris.

The weight of the lantern is about four tons. The total cost of construction was (including erection in the park and taking down hereafter) £10,000 sterling.

The tunnel of Ivry, a model of which (1-25th full size) is exhibited, is chiefly remarkable for the skilful manner in which the difficulty of obtaining a secure foundation for the masonry of the tunnel has been overcome.

This tunnel carries the girdle railway of Paris beneath the Champ de Mars of Ivry, is 220 yards long. Its permanent way is about forty feet beneath the surface of the ground. The formation through which it is driven is sand, above a marl bed, which overlies a stratum of calcareous stone, good for building purposes, and formerly much used in constructions in Paris. The quarrying of this stone has left considerable cavities beneath the site of the tunnel, which have necessitated the precautionary measures for securing its foundation shown in the model.

To carry down the side walls of the tunnel to the solid floor of the quarry, as first intended, would have involved immense expense; and as it was found that the stratum which intervened between the required level of the permanent way of the railway and the excavations beneath was of a solid nature, it was determined to shore it up from below with masonry walls, exactly beneath the site of the side walls of the tunnel, and to fill up the cavities between these lower foundation walls with rammed earth. To effect this, two galleries

were driven beneath and parallel to the intended tunnel; these were lined with masonry walls, so placed that one (the thicker of the two and the nearest the axis of the tunnel) should coincide in plan with the side wall of the tunnel, and should support the stratum of rock upon which the latter should be built.

There minor galleries were arched in, and served as galleries of inspection, by means of which the foundations could be examined both during the progress of the work and after it had been tested by the passage of trains. Many difficulties occurred in the execution of the work, owing to the ground having been largely fissured by faults in the quarry veins. A serious obstacle was met with, owing to a part of the old quarry having caved in beneath the superincumbent earth. The earth which had slipped had assumed the form of a truncated cone of about 30 ft. in diameter at base and 15 ft. at its upper surface. In order to carry the foundation gallery through this fault, it was necessary to support the whole circumference of the slip upon masonry carried up from the solid rock. This done, the whole of the loose *déblai* was removed through the gallery of inspection, and, piers being then built up at the extreme edge of the slip, an arch was thrown across the space, and the pier wall of the tunnel built upon it. It will be readily seen that this was a critical and difficult piece of work. It was carried on night and day in reliefs, under the direction of M. Bassompière, engineer in chief des Ponts et Chaussées.

An extremely ingenious system of syphons recently applied in France to large reservoirs for the purpose of getting rid of the surplus and storm waters, is shown by two mode's, one of 1-40th full size, and another of the head of the syphon-feeder 1-10th full size.

The system presents some novelty, has been found to work well, and it is intended to apply it to other reservoirs in France.

The apparatus consists of two cast-iron syphon-pipes 27 in. internal diameter, 8-10 in. thickness of metal, through which the surplus waters are discharged. To these are attached two lesser auxiliary pipes, whose internal diameter is about 4 in. These latter communicate with the larger pair at the highest part of their curve, and are the means by which the discharge is regulated.

In order to protect the apparatus from frost and from injury from any other cause it is inclosed in a masonry chamber formed in the dam, and communicating with the reservoir by a port (*a*), which is usually open; it can, however, be closed for repairs, &c. There is a second port in the chamber which is closed by a sluice-gate (*c*). This is only opened to empty either the chamber or the reservoir. The upper part of the auxiliary pipes or feeders, which have been described as being attached to the larger pipes, does not communicate directly with the reservoir. This upper part is within the masonry chamber, about ¼ in. above the prescribed water level of the reservoir. Its attachment to the pipe is by means of a water-tight expansion-joint, which allows it vertical play. As long as the reservoir is at below its prescribed water level the syphon is inactive; but as soon as it rises above that level it begins to flow away through the small pipe, and, the water continuing to rise, the head of the latter becomes completely submerged; the downflow of the water through the small pipe draws with it the air contained in the elbow of the syphon, and the latter begins to work until, the discharge having reduced the water to the prescribed level, air is re-admitted to the bend of the syphon and its operation stopped. So long as the depth of water over the head of the feeder is less than 2 in., the whirlpool formed by the pressure of the atmosphere at the orifice causes the syphon to draw air as well as water, and therefore to discharge with reduced volume; as soon, however, as the water has risen to 2 in. above the head the syphon works full bore, and discharges at the rate of 1500 gallons per second.

The apparatus is therefore self-regulating as well as self-acting.

The system claims, and appears to possess, the advantages of being simple in construction, certain in operation, and not liable to get out of repair.

The feed apparatus, which is the only novelty, is the idea of M. Hirsch.

The principal public buildings and restorations executed in Paris during the last twelve years are recorded in an atlas of plans exhibited by the Department des Travaux Publiques. The extent of these works may be gathered from their cost, £6,630,180. The designing of these works shows not only great skill expended upon the construction itself, but a skilful adaptation of site and judicious utilisation of ugly waste spaces have also contributed to the general embellishment of the capital. It will be remarked that in the designing of hospitals and lunatic asylums great care has been taken to obtain a cheerful look-out from the ward windows. In the arrangement of the public abattoirs the approaches from the railway stations have been studied so as to give the least amount of street through which cattle are driven, whilst the disposal of the dead meat is made as easy as possible. None of these details have been left to take their chance.

The next work selected for notice—an undertaking being carried on, not upon French territory, but the credit of which is due to France—is, perhaps, the most interesting object of civil engineering at present in progress in the world—viz., the cutting the maritime canal through the Isthmus of Suez; models, plans, photographs, and a panorama of which are exhibited in a detached building in the park, constructed in the style of an Egyptian temple. No one exhibit has attracted more of the attention of the visitors to the Champ de Mars than have these models, and none has better repaid the trouble of examination. The works which they illustrate deserve attention alike from their great magnitude and importance from an engineering point of view and from the greatness of the beneficial influence which their completion is likely to exercise upon the commerce of the world.

The idea of this great work, by which we hope the whole civilised world is shortly to be benefited, is due to M. le Baron Lesseps, who has long interested himself with the affairs of Egypt, having filled an important diplomatic post for many years in that country. The execution of the scheme is due to French engineering skill, and the principal part of the capital has been subscribed in France.

The works are illustrated by a model of the isthmus on a scale of 1-50,000th; the heights are comparatively exaggerated, 60 to 1; the width of the canal, 6 to 1.

The Isthmus of Suez, at the part selected for the operations of M. Lesseps, is about seventy-two miles wide, measured as the crow flies, from Pelousa, on the Mediterranean, to Suez, on the Red Sea. The levels of these two seas is not far from identical, the mean level of the Red Sea being but 6½ in. higher than that of the Mediterranean. The general character of the isthmus between Pelousa and Suez is flat, and is the natural water basin of the adjoining countries, which slope gradually towards the isthmus, east and west, from Asia and Africa. Starting from Pelousa, and following, southwards, the line traced out for the canal towards Damietta, we come to the lagunes of Menzaleh, about twenty-five miles long, separated from the Mediterranean by a strip of beach, which runs out shoal for a considerable distance into the sea. The Mediterranean mouth of the canal is cut through this strip; and here, situated eighteen miles west of Pelousa, is Port Said, created by the company to be their base of operations, and where are established considerable workshops for the maintenance and repair of plant.

Formerly these desolate lagunes of Menzaleh were vast cultivated plains, which, fertilised by the Tanitique branch of the Nile, supported a considerable population, and grew a large quantity of the corn which supplied the granaries of ancient Rome.

After leaving the lagunes the line of the canal cuts through a strip of sand about four miles wide, elevated about 4 ft. above the sea; this strip separates the lagunes of Menzaleh from those of Ballah, the width of which is fourteen miles. Then occurs the elevated plateau of El Guisr, the highest ground between Pelousa and Suez; through this the canal is carried in a very considerable cutting, nine miles and a half long, with a maximum depth of 55 ft. After crossing this plateau a depressed plain is reached called Lake Timsah; the lowest level of this plain is 19 ft. below the water of the Mediterranean. On the borders of Lake Timsah, or Lake of the Crocodiles, is Ismailia, a town built by the company midway between the Mediterranean and Red Sea, where they have located the general direction of the works. The line then crosses a second elevated plateau called Serapeum, 46 ft. above the level of the Mediterranean, and nine miles long. South of this lie the lakes of Amer, two shallow lagunes separated by a narrow strip of sand; the exact line which the canal will follow through Lakes Timsah and Amer has not yet been decided upon. This part of the canal will be left until the rest of the line is completed. Meantime, water-communication across them is obtained by admitting the water of the Mediterranean into Timsah and the Red Sea into Amer, thus transforming them into navigable inland seas. Beyond the lakes of Amer is the raised ridge of Chalouf, 26 ft. above the level of the sea, the southern slope of which forms the plain of Suez, elevated 6 ft. 6 in. above the sea level. After crossing this plain, the lagune of Suez is reached, which communicates by a shallow inlet with the Red Sea.

Thus the total length of the canal is about 100 miles, of which thirty-seven miles is in cutting, whilst sixty-three miles are at or beneath sea level.

The first work undertaken by the company, preliminary to their main work, was the extension, as far as Lake Timsah, of the old fresh-water canal, which, starting from Moës, wound eastward, past Abassieh to Ras-el-Ouady. This extension gave them means of transport for their provisions and materials from the Nile into the very heart of the isthmus, a supply of water for their workmen and for their engines, and enabled them to establish their central dépôt of Ismailia. Southwards from Ismailia the fresh-water canal was continued nearly parallel to the intended line of the maritime canal as far as Suez, and northwards the water was led in pipes from a reservoir at Ismailia as far as Port Said, following the line of the works. The original source of supply of the fresh-water canal from Moës was supplemented by a cut from the Nile at Boulak to Abassieh, forty-four miles long; the cross section of the fresh-water canal is 56 ft. at water level, 26 ft. at bottom, and 6 ft. 6 in. deep.

The general dimensions of the maritime canal are:—width at water level in embankment, 328 ft.; ditto in cutting, 190 ft.; width at bottom, 72 ft.; depth, 26 ft. 3 in.; the batter of the sides varies with the nature of the soil, the steepest slope being about 2½ to 1.

The sectional form of the canal has been the subject of anxious consideration. It was originally intended to make it somewhat narrower than the above dimensions, and steeper at the sides; but it was found that at or near the water's edge a slope as steep as 2 to 1 was subject to degradation from the wash of passing vessels; the general batter from about 4 ft. below water level to the bottom is now intended to be from 2½ to 1 to 3½ to 1, whilst the edge is considerably flattened so as to approximate to the shelving form which sand assumes when acted upon by the wave from passing vessels.

The first work of digging through the strip of head separating the Mediterranean from the lagune of Menzaleh was performed by fellahs supplied by the Egyptian Government; the mode of operation was the old one of scooping the sand and carrying it in baskets on the head. The work of the fellahs was confined to the higher and drier parts of the excavations, the lower part being performed by means of steam-dredges, twenty of which were put in operation by the company; these dredgers were driven by 15-horse power engines, lifting twenty-six gallon buckets at the rate of twenty per minute. The sand dredged north of the beach was deposited to form the platform upon which Port Said was subsequently built; the sand excavated on the south side was placed so as to form the canal banks, *en cavalier*, through the lagunes. By these banks the waters of the canal were isolated from those of the lagunes, guarding at once against sudden variations of water level arising from storm, and protecting the bed of the canal from being silted up by sand blown across from the plains. A good illustration of the works in the great cutting of El Guisr, as carried on by fellahs, is given in the drawing which hangs on the wall on the right on entering. When this cutting was about half accomplished, the supply of fellah labour by the Egyptian Government was stopped; the primitive baskets of sand carried on human shoulders disappeared from the scene, and were replaced by MM. Borel and Lavally, and M. Couvreux, contractors, with steam instead of human power.

M. Couvreux contracted for the enlargement to its full destined width and depth of the cutting of El Guisr. Messrs. Borel, Lavally, and Co. undertook the remainder of the work. The modes of carrying out the works adopted by Messrs. Borel and Lavally are shown in the great model in the centre of the room. The model on the left bank of the canal shows the mode of disposing of the sand dredged from the bed of the canal—by tipping the dredge-buckets direct into a long shoot which leads inshore from the top of the dredge-frame. This shoot is inclined towards the shore at a gradient sufficiently quick to enable the silt charged with water to flow along it. The discharge is assisted by pumping water into the dredge end of the shoot, by means of two rotatory pumps worked by the engine of the dredger, supplemented, in case the nature of the silt requires further liquefaction, by a second pump placed upon the barge, and worked by a portable steam-engine. The descent of the silt is further helped by scrapers, fitting the concave surface of the shoot, attached to endless chains passing over pulleys fixed at each end of the shoot. These scrapers are also driven by the dredger-engine. These shoots are 230 ft. long; their section is a semi-ellipse, 5 ft. wide and 2 ft. deep. They rest upon a pair of lattice girders, which latter are carried by an upright iron framing, standing upon a barge moored inshore of and parallel to the dredger. Lateral and vertical play is allowed for in the attachment of the shoot to the top of the frame of the dredger, and to the frame carried by the barge. The dredger-engine is a direct-acting, double-cylinder condensing-engine of 35-horse power (nominal). The gradient of the shoot is varied to suit the description of the silt dredged. To discharge fine sand a fall of 1 in 20 is sufficiently steep, but the pumps have to supply a volume of water equal to half the sand; with clay a fall of 1 in 12 is necessary, but less water suffices. The mode of disposal above described is the most expeditious and economical in use on the works; it is applied in all cases where the height of the bank is not too great. Each dredger and shoot is calculated to dispose of about 1200 cubic yards per day.

Where the banks are too high to be commanded by the shoot, another apparatus is used—the "Appareil Elevateur," a model of which is shown upon the left bank of the canal. This apparatus is designed to lift trucks full of sand from barges and run them to tip inshore; it consists of two parallel lattice girders, extending from a barge moored to the shore, in a direction parallel to the canal, carrying upon their upper edges a tramway, which rises shorewards at a gradient of about 1 in 6; the lower end of these girders is about 10 ft. above the level of the water, the shore or higher end 46 ft. This frame is supported at two points, about 14 ft. apart—viz., one on a barge moored close alongshore, the other on a platform-carriage on the shore. Sufficient preponderance is given to the canal end to support the shore end, together with the weight of a full waggon. Very considerable ingenuity is exhibited in the arrangement of the framing, and in its attachment at its points of support, so as to render it sufficiently flexible to be non-susceptible of injury from the rolling of the barge, whilst its strength is sufficient to carry the weight of the full trucks running over it. On the tramway runs a carriage, consisting of two pairs of flange wheels and axles, kept about 4 ft. apart by means of two horizontal pieces resembling the fiddle-sticks of a tip waggon; the wheels are keyed to the hinder axle; they run loose on the fore axle. To this carriage is slung the sand-truck, and it is the vehicle by which the latter is carried inshore. The fore axle of the platform carriage is thickened between the wheels, so as to form two drums of different diameters; to the lesser of these is attached a rope, which lifts the sand-trucks from the barge, and to the larger a second rope is attached, which passes over a pulley-wheel at the shore end of the tramway, and which draws the full waggons up the incline from the barge. The working is as follows:—The sand, which has been shot by the steam-dredger into boxes resembling ordinary end-tip waggons, containing about three yards cube, is carried by a barge to the lower extremity of the elevator; a tackle attached to the small drum above described is hooked on to rings in the side of the waggon; the waggon, thus slung to the platform carriage, is hoisted by the engine to a height sufficient to allow of two small truck wheels, which are attached to the hinder end of the waggon, being engaged in the metals of a second tramroad placed below, and for five sixths of its length parallel to the first. The engine, by pulling over the pulley-wheels, drags the carriage up the incline to the shore end of the elevator. The discharge of the contents of the sand-waggon is managed in the following way:—As has been already stated, the upper and lower tramways are laid parallel to each other throughout about five sixths of their lengths. At the shore end, however, they converge the gradient of the lower tramway, on which run the small truck wheels of the sand-waggon, being considerably steepened: the hinder part of the waggon is thus borne up, whilst the forward, or tip end, is thrown down, so that the catch of the tailboard being disengaged the contents are shot. The empty truck then runs down the incline, is lowered into the barge, and a full one picked up. There are at present eighteen of these elevators at work; each of them takes two of the large dredgers to feed it.

M. Couvreux has employed an apparatus termed a dry dredger in the enlargement and deepening of the great cutting of El Guisl. The apparatus consists of a platform carriage 20 ft. long by 10 ft. wide, mounted upon nine wheels, running on a three-rail tramway. On this is a steam-engine driving a chain of dredge buckets, which mount a jib projecting perpendicularly from the platform carriage, and which tip their contents into sets of earth-waggons which run upon a second tramway parallel to the first. The trains of sand-waggons are then run to tip by a locomotive. Each of the dry dredgers shift about 900 yards cube per day of loose fine sand. The soil met with in the line of excavation for the canal is chiefly sand, river mud, and clay. A vein of rock crossing the ridge of Chalouf, about 3 ft. above the canal bed, is the only excavation which requires blasting.

A very considerable work in connection with the undertaking of M. Lesseps has been the construction of Port Said, the Mediterranean harbour of the canal. This port is formed by two breakwaters running out a considerable distance into the sea; their shore ends being 4592 ft. and their sea ends 2296 ft. apart. The west breakwater is 10,168 ft. in length; the east 5000 ft. Their upper suface is 17 ft. wide, their sides batter 1 to 1 to the base. The harbour inclosed by these breakwaters is being dredged out to a uniform depth of 30 ft. The material used in their construction is concrete blocks composed of sand and ground lime of Theil (from Ardèche, in France), the proportions being one of lime to four and a half of sand. The works of Port Saïd are being carried out by MM. Dussand, who have already constructed, with the same material, breakwaters at Marseilles, Cherbourg, and Alger. MM. Borel and Lavally have guaranteed the completion of their works on Oct. 1, 1869.

The great work, of which the above is a very brief and imperfect sketch, will well repay an attentive study. There is no country so directly interested in its success as is England, the mistress of India. Hitherto it has been the fashion to consign the Suez Canal to the limbo of great impracticable schemes; we venture to think that amongst the many doubting Englishmen who have visited the models in the Paris Exhibition, and have been induced to inform themselves of what has been done and is doing, there are not a few who will have their scepticism in the feasibility of the scheme somewhat shaken.

America exhibits but few specimens of her engineering skill, and respecting those few it was by no means easy to obtain much detailed information.

A bold engineering scheme for the supply of water to the city of Chicago, in Illinois, is recorded upon a plan hanging against the west wall in the United States section, numbered 7 in general catalogue.

Chicago, the capital of Illinois, is situated upon the great lake of Michigan, whence it derives its supply of water.

The pollution of the water near the shore proceeding from the discharge of the town drains, &c., rendered it necessary that the supply for the use of the town should be drawn from a considerable distance out in the lake, and with this view a shaft consisting of cast-iron pipes 9 ft. diameter and 2½ in. thick (in seven lengths of 9 ft. each) was sunk from the surface of the water, two miles from shore to about 35 ft. beneath the bed of the lake. The depth of the lake is here about 28 ft.

The part of this pipe which extends from beneath the level of the bed of the lake to its greatest depth is cased with brickwork in cement. The part of the pipe which stands in the water is protected from the action of the waves by a breakwater built round it in the form of a pentagon. This breakwater is a strong wooden framing, filled in with coarse concrete or rubble masonry. From the lower extremity of this shaft, 63 ft below the surface of the lake, a circular tunnel, lined with brickwork, in cement, and 5 ft. diameter in the clear, and two miles in length, is driven beneath the bed of the lake towards the town, where it meets a second vertical shaft sunk within the shore line. This latter communicates through a chamber containing five wrought-iron regulating sluice-gates, with a reservoir from which, by means of a large pair of pumping engines driven by steam-power, the water is lifted to a water tower 120 ft. high, and distributed all over the town. A legend on the plan states that the work is the design of Mr. Coote, and that it has been three years in construction.

A good example of the ingenious application of wood to bridge construction, for which America is famous, will be found in a model 1-40th full size of a wooden railway swing-bridge which has recently been constructed in the State of Ohio. Timber bridges are specially suited to a new country where timber is cheap, and where it has been necessary to open up a new country rapidly and economically. These structures are, however, to be considered as essentially temporary in their character, and are generally built with a view to their being replaced at some future time in some more durable material. The bridge exhibited here is of a larger span than usual in designs of this class. Each opening has a clear span of 150 ft.; the diameter of turn-table is 30 ft.; length of bridge over all, 335 ft.; the depth of the truss is 10 ft. at the ends, 34 ft. at the centre. The arched part is composed of four timbers, 10 in. by 6½ in.; main struts, 14 in. by 8 in., extend to each side from the turn-table to give support to the arched top, which is further strengthened by three straining pieces 8 in. by 10 in. The chord consists of four 12 in. by 6½ in. timbers, and is put together with a camber of about 6 in. The weight of the bridge is 200 tons.

Within the space to which it is necessary to restrict this memorandum it has been impossible to do more than briefly to call attention to a few of the most noteworthy exhibits. It will be seen that, though the progress of civil engineering has not been fully represented, no country having put forth its full strength but France, there is still much exhibited that is interesting and instructive.

THE BRITISH BOILER-HOUSE IN THE PARIS EXHIBITION.

The idea of exhibiting boilers in action has been carried out by the British executive, for the first time in an international exhibition, with entire success; and numbers of visitors, without any discomfort from heat, dirt, smoke, or steam, may constantly be seen inspecting the grim, fiery, puffing machinery in the cool arcades of the British boiler-house. Whilst other countries have exhibited interesting copies of their national architecture in the park, England has attempted a structure which is certainly original and graceful, and which fulfils its purpose. Captain Beaumont, R.E., designed the ground plan (see Engraving) and the arrangement of the several boilers, made by Galloway, Hayward and Tyler, and Howard, as well as other machinery connected with the production of steam. The supply has been ample, and continues without interruption, and it was ready the day before the opening, on April 1. The covering structure was suggested by the photographs, in Mr. Hope's "Architecture of Ahmedabad," of Syud Osman's tomb. It gives an example how usefully the architecture of India may be studied for suggestions. In India, protection from great heat is a necessity, and the buildings naturally afford it. In Paris a similar necessity arises; and India furnishes exactly the proper type for a suitable building, a type which it has been shown can be adopted without servile imitation of Hindoo details.

TERRA-COTTAS.—CLASS 65.

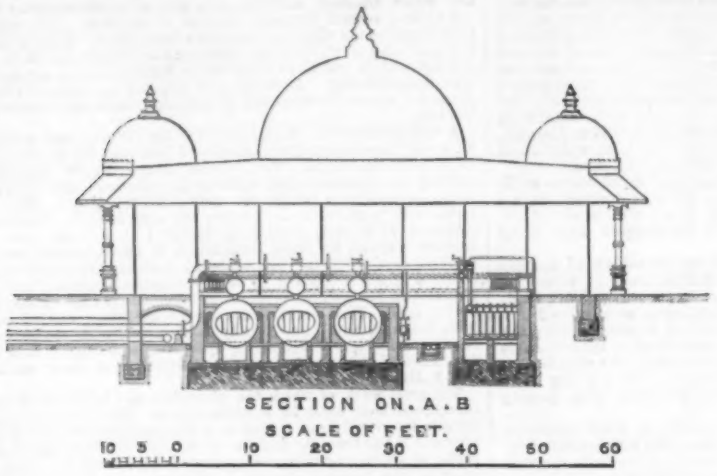
BY HENRY COLE, C.B.

That history repeats itself is shown by the revival of the use of terra-cotta at the present time. Six thousand years ago baked, cocked, or burnt earth—terra-cotta—was common enough in Egypt, and was the building material of that people. It was used by the Greeks, by the Romans, and by various European countries in the

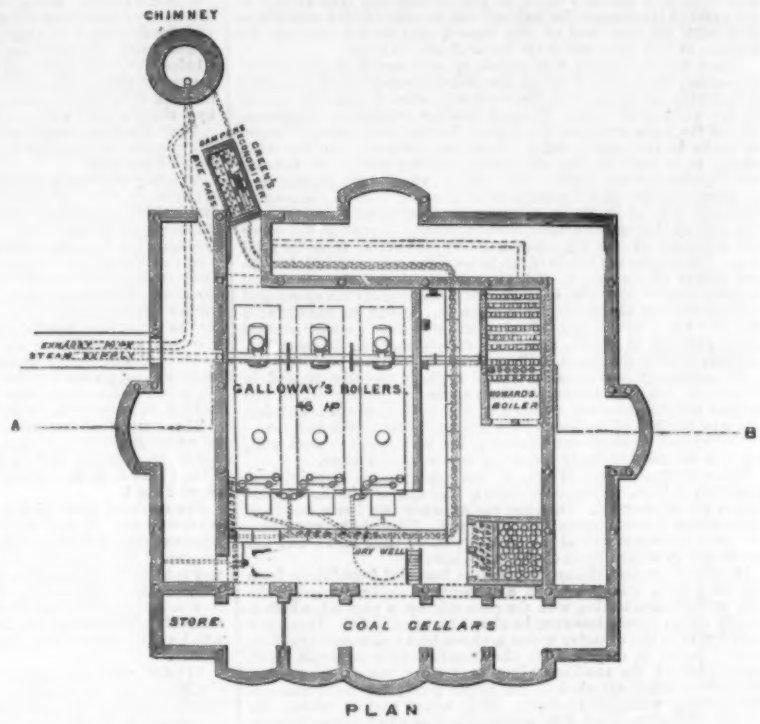
THE PARIS INTERNATIONAL EXHIBITION.

Middle Ages; and now in the Paris Exhibition proofs are afforded in all parts of it that modern Europe is largely reviving the use of terra-cotta.

In humid England, and especially in its smoky manufacturing towns, terra-cotta is far more durable than most building stones. It will bear much greater strains than many kinds of stone of equal proportions. It is more durable than ordinary granite, as may be seen on the lodge in Merrion-square, Dublin, which was built about 1786. The granite mouldings there cut in stone from the Wicklow Mountains are all worn away and rounded by the action of the rain, whilst Coade's terra-cottas, dated 1788, are as sharp as when they were first placed on this lodge. Again, at Sutton House, three miles from Guildford, in Surrey, where the entire structure is covered with ornamental terra-cottas, inspired, possibly, by Torrigiano, about 1530, the terra-cottas, where they are properly compounded and baked, show the marks of the modelling tool as clearly as when they came from the maker's hands. The visitor to Paris has only to go to the Louvre and examine the Greco-Roman and Etruscan terra-cottas, collected by Campana and admirably arranged, in the fine new room, to see how perfect the terra-cotta remains after 2000 years. The woodcut of the guard-house of the seventh cohort of



SECTION OF BOILER-HOUSE (CLASS 65).



PLAN OF BOILER-HOUSE (CLASS 65).—SEE PAGE 373.

Vigiles, or fire brigade, about A.D. 222, published a few weeks ago in the ILLUSTRATED LONDON NEWS (p. 269), furnished a fine illustration of the uses of this material 1650 years since. It is desirable that our archæologists should prepare a chronological list of the existing illustrations of the use of terra-cotta from the earliest ages.

The clays used in the manufacture of terra-cottas are intermediate in quality between those used for ordinary bricks and those employed for porcelain. They are more finely ground, and have a smaller proportion of impurities, than the brick earths; but are not so carefully ground and worked, nor so pure, as the porcelain clays. The red terra-cottas, however, like red bricks, derive their tint from the presence of oxide of iron, an impurity of which China clay contains hardly a trace. Its goodness and durability depend upon the completeness of its careful mixing or kneading, and on careful and hard burning. Many specimens in the Exhibition from the same factory are good or bad—are hard, and turn the knife's edge, or are soft—just in proportion to the extent of the firing they have received. The colour, too, is affected by the firing; and beautiful tints, delicate as those of marbles, are produced by the gradations of the heat and mode of burning. Such variations of tint add greatly to the variety and interest of the material, but they are not yet generally liked by architects.

FRANCE.

In taking a survey of some of the most remarkable of the numerous examples shown in the Exhibition, it will be convenient to begin with those of France. But the inquirer will find the terra-cottas much scattered inside the building and outside in the park, and in unexpected places. Terra-cottas form part of class 65 in the machinery group. In the midst of the machinery gallery are the productions of Emile Muller et Cie., à Ivry, Seine, France (32). They exhibit various architectural forms: hollow bricks which are enamelled, also tiles and chimney-pots enamelled; and seem to be in much communication with the French architects. There is a finial designed by Viollet Le Duc, the celebrated architect and archæologist; a head of a window by Davioud, architect; a specimen from the Empress's pavilion, by Demimind; a finial by Laval; an architectural ornament from the Eglise Montrouge by Vaudremer; together with terra-cottas and roofing-tiles glazed in various colours.

Garnaud, France (31), exhibits terra-cotta very white and monotonous in tint, but it seems doubtful if it be well baked.

On the French side of the park, next to the shop of the Cashmere des Indes on one side and a specimen of a workman's house on the other, and directly opposite the stuffed ox, is the exhibition of Messrs. Virebent, frères et fils, à Toulouse, "manufacture de grès ceramique, construction, ornamentation, statuaire et peintures émaillées" (France, class 17, No. 16). They exhibit a boldly-modelled, gothic finial, upwards of 7 ft. high, made up of different pieces, with glazes of orange, green, and transparent brown. It is highly suggestive to architects for all styles. Messrs. Virebent's principal exhibit is in the form of a triangular chapel, of a hybrid Byzantine character, showing all the varieties of their various processes. Figures are painted in enamel upon the columns, and subjects are painted upon tiles used both on walls and as a pavement. The whole, although *bizarre* and to be avoided for direct imitation, is remarkably useful for its suggestiveness. It stands about 22 ft. high, and the cost is about £300. Next, on the east side, is the collection of Boissimon, à Langeais, Indre et Loire, France (class 17, Nos. 81 and 14). The roof of his temple is supported by enamelled pottery columns, moderate in price. He exhibits a great variety of vases and implements; cheap, but of doubtful taste; all, however, suggestive. On the north side is an enormous group in terra-cotta, by Gossin Frères, 57, Rue de la Roquette, Paris (France, class 17, No. 95), representing a shipwreck. It is made up of several portions, and is an illustration of the employment of terra-cotta for large groups of sculpture. It is more remarkable for its accumulation of parts and size than anything else. Messrs. Gossin have other subjects scattered in various parts of the grounds, which, being painted, the character of the material cannot be criticised. De Bay (Mdme.), 107, Rue d'Orleans, also in the park, in front of Rouze's restaurant (France, class 17, No. 76), exhibits varieties of architectural elements, together with vases and statues. Much of the material is excellently compounded and well baked. In the designs, group No. 2, are some skilful imitations of Persian columns by Collinot.

PRUSSIA.

The terra-cotta of Prussia is excellent in material; hard, compact, well baked; but, according to German taste, is monotonous in colour. It makes a considerable show. E. March (62), Charlottenberg bei Berlin, is the principal exhibitor. He admirably manufactures terra-cotta of a yellowish, stony tint, also of red earth, both hard and compact. He shows a monument, with the figure of Minerva, about 9 ft. high, and at the base are griffins, forming arms of seats. It is excellent work. Carl Friedenthal, Geissmannsdorf, Silesia (22), shows some heraldic roundels, 5 ft. in diameter, of yellowish colour, striking for size and workmanship. A. Augustin, Laubau, Silesia (63), exhibits a remarkable, pressed-brick construction, ornamented with red terra-cottas, which are very hard and well baked; but the joints between the bricks are half an inch wide, and are coloured like the brick; very unlike the best English brickwork, which is as closely jointed as possible. All these are in the machinery zone.

WIRTEMBERG.

So is Staib-Wasserott, Ravensburg (2)—A large bracket about 3 ft. 6 in. in projection is a good specimen exhibited by him.

AUSTRIA.

To see the Viennese terra-cotta the visitor must leave the machinery gallery. Henry Drasche, Vienna (11), makes a great show of terra-cotta in the south-west corner of the park facing the Ecole Militaire. The colour is not good, being of a reddish earthenware tint. The baking appears to be capricious; in some cases thoroughly done, in others leaving the terra-cotta very soft and friable. Count Larisch, of Mönich Engin, zu Tolnisch Leuten, shows three or four samples of excellently manufactured and well baked terra-cotta in the park.

SPAIN.

Exhibits a few samples of well made terra-cotta to which the jury have given an honourable mention. They are in the Park.

ITALY.

In the park, betwen the United States restaurants and the United States machinery, M. Boni, of Milan (36), has erected a porta in his peculiar red-orange tinted terra-cotta, or it may be a recess and not

FIG. 1.

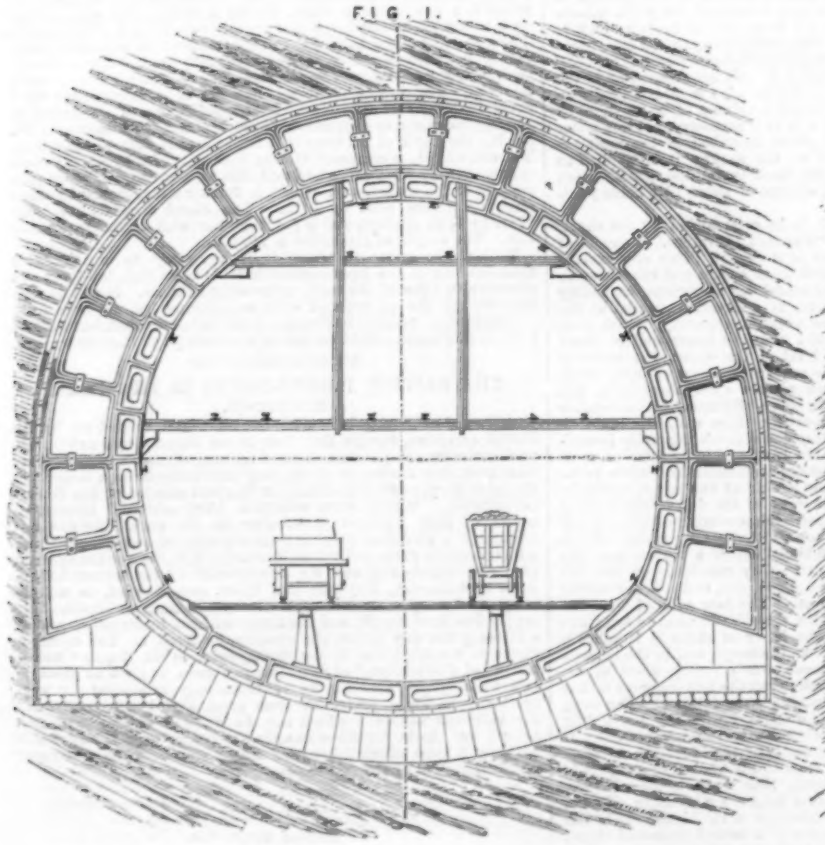
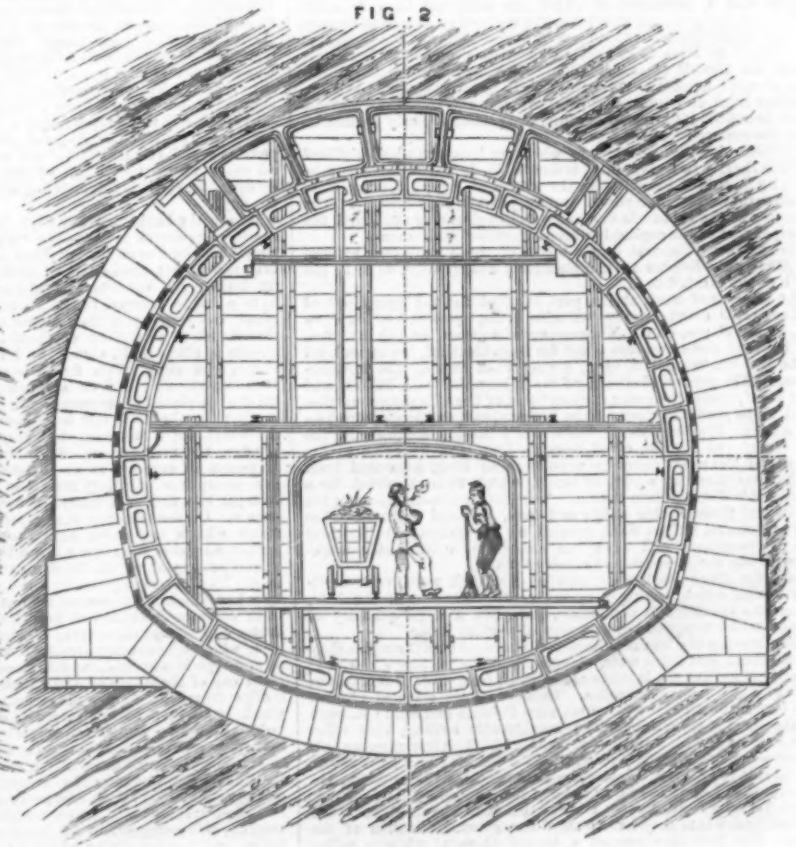
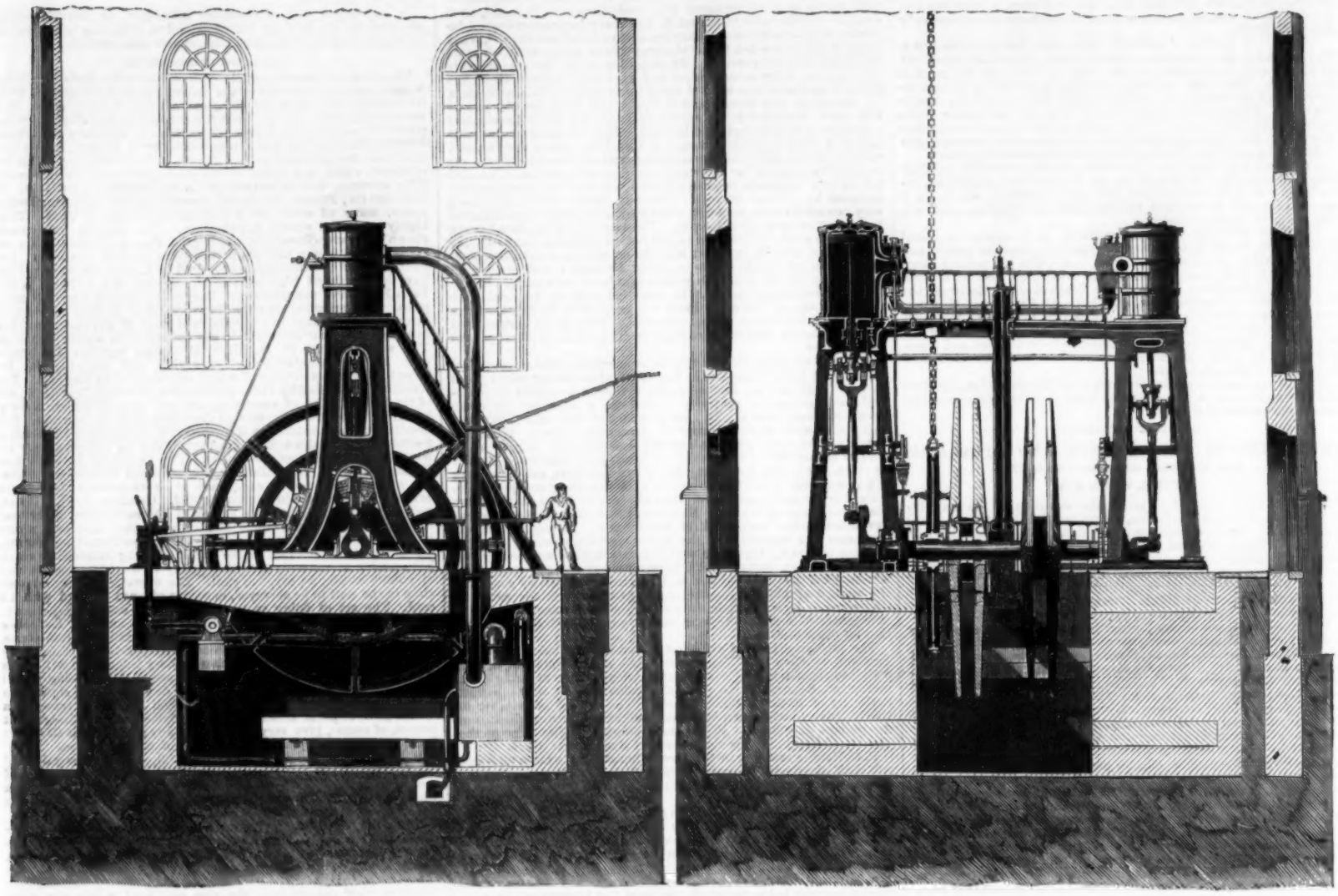


FIG. 2.



SYSTEM OF TUNBELLING (CLASS 65).—SEE PAGE 374.

THE PARIS INTERNATIONAL EXHIBITION.



COLLIERY WINDING-ENGINES (CLASS 47).

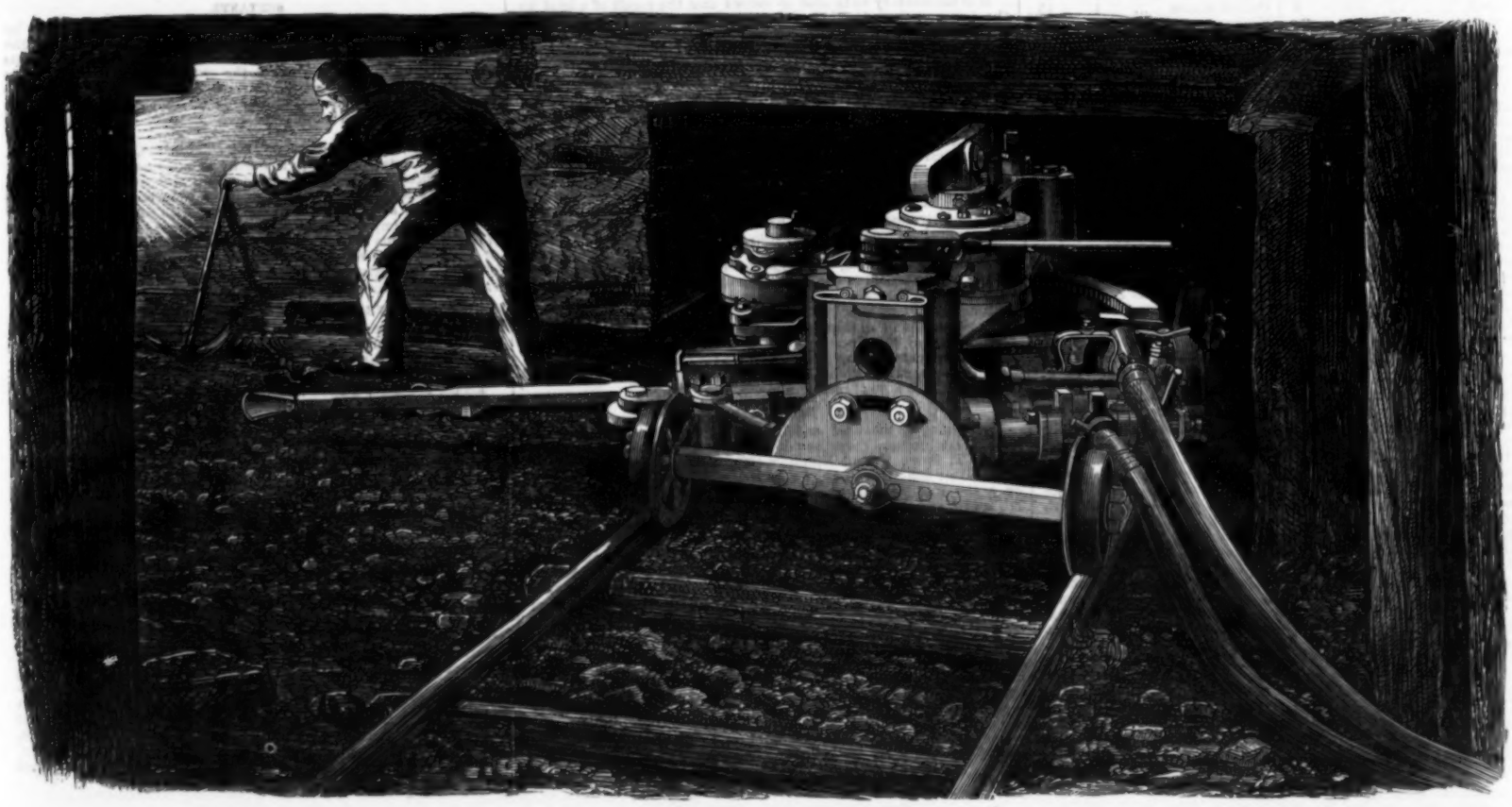
a doorway. The front is divided into panels, as though it were a doorway. It is a large and imposing work, standing upwards of thirty feet high, made up of many parts and many styles of ornament—busts, bas-reliefs, full-length statues, profiles, portraits, arabesques (which seem to be borrowed from Munich), animals, griffins, &c.—sharply modelled; but how different in style to the Mediæval terra-cottas at Milan and Pavia, close to his works! It is a curious salmagundi, probably brought together to show how ready M. Boni is to accommodate his material to everybody's taste. It does not seem to be very highly burned; sufficiently, perhaps, for an Italian climate.

ENGLAND.

But the most extensive show of terra-cottas is made by the English. In the Machinery Gallery Messrs. Blanchard (successors to Messrs. Coade, in Blackfriars-road) exhibit various architectural details, especially two noble columns of Godfrey Sykes's design, which have been engraved in the ILLUSTRATED LONDON NEWS, vol. 49, p. 305. These are built upon a basement made by Mr. Blashfield, of Stamford. There is not much to choose between the qualities of these samples of terra-cotta—both good. Blanchard's are variously and agreeably tinted by the "firing," while Blashfield's affect a monotony of tint. Close to these terra-cottas are those samples of moulded bricks, by Norman, of Hurstmonceux, Sussex, which may be instanced as the perfect bricks of the Exhibition. Outside in the park Mr. Pulham, of Broxbourne, shows, among other things, the tomb of Mulready, R.A. The material is excellent. The recumbent figure of the artist is the original clay model, and exceeds 6 *ft.* in length—a *tour de force* of baking in England. But in France M. Gille produces in one piece a figure above 7 ft. high, not in terra-cotta, but in hard porcelain!—a feat which no English potter has yet attempted. This remarkable work is exhibited in one of the "carrefours" in the pottery group in France.

The most extensive use of terra-cotta, however, is in the boiler-house for generating the steam necessary to move the British machinery. All the other boiler-houses in the park are inclosed, and therefore so hot that no one but an engineer will go into them. The aim in the British boiler-house was not merely to make the steam, but to show several varieties of boilers by different makers, and to attract the public to visit them, which has been successfully accomplished. To do this an open, cool, and self-ventilating structure was necessary, and so was a chimney-shaft. The colonnaded temples in India furnished exactly the type of structure wanted for both house and shaft, and the British boiler-house was designed upon Syud Oosman's tomb of the fifteenth century, at Ahmedabad; but Italian terra-cotta and not Hindoo details were used for the sake of economy, in order that they might be employed hereafter in England. In the chimney-shaft are used good moulded brick, by the Bishop's Waltham Company, who show the excellence of their clay in some pottery in the building. This boiler-house has excited much interest, especially among foreigners, and is illustrated in this Journal.

Before leaving the subject of terra-cottas, the visitor should betake himself to Mr. Beresford Hope's division, illustrating "arts cognate to architecture." It is next to the British picture-gallery, and good specimens of Blashfield's terra-cottas, designed



HYDRAULIC COAL-CUTTING MACHINE (CLASS 47).—SEE PAGE 385.

by Mr. C. Barry, as well as other specimens by Pulham, will be found there.

The revival of terra-cotta for architecture is comparatively in its infancy. The prices of the makers are capricious: sometimes English tenders will show a difference of 300 per cent, or more. In France, slabs of terra-cotta, glazed, about 2 ft. long by 18 in. wide, cost 5f.; in England they cost 18s. But in France, a large majolica column would cost four times as much as the same column made by Messrs. Minton.

The price in London of ordinary terra-cotta facing for buildings with a bond of 4½ in. and 9 in.—that is to say, with an average bond of 6¾ in.—may be assumed to be from 3s. 4d. to 3s. 6d. per foot superficial. The price will vary somewhat, according to the intricacies of the ornament, and also with the size of the blocks required. When coal and clay are both to be had at the site of the manufactory the work can, of course, be executed more cheaply than when they have to be brought from a distance, and it appears probable that a reduction of 50 per cent may be eventually made.

The expense of fixing the terra-cotta on a three-storied building may be assumed to be from 1s. to 1s. 2d. per foot, superficial, including materials and hoisting, but not scaffolding, which, as it would generally be required for the bricklayers' work, need not, therefore, be specially erected.

The great buildings now contemplated, or in course of actual construction, in different parts of Europe will equalise prices, and afford valuable international lessons. At Munich several large buildings in brick and terra-cotta are completed. So in London there are the two large hotels of the South-Eastern Railway, the Sun Fire Office at Charing-cross, and the South Kensington Museum, and the Royal Horticultural Gardens, where terra-cotta has been used for decoration. At Berlin a great chemical college is nearly completed. The new cathedral at Berlin is to be of brick and terra-cotta; and so is the new covered coliseum, the Albert Hall, now erecting at Kensington-gore.

These are among the evidences which show that Egyptian, Grecian, and Roman history, in terra-cotta at least, is now being repeated among the nations of Europe.

PHILOSOPHICAL INSTRUMENTS AND APPARATUS

FOR TEACHING SCIENCE.—CLASS 12.

BY C. R. WELD, ESQ.

ALTHOUGH not calculated to arrest the attention of the majority of visitors to the Paris Exhibition, the philosophical instruments and apparatus for teaching science take high rank among the vast variety of objects amassed in the Champ de Mars. For it is by means of instruments like these that Nature has revealed many of her most important secrets to man. Viewed in this light, an examination of the philosophical instruments in this remarkable Exhibition cannot fail to be deeply interesting and at the same time instructive.

Without the means of instituting experiments, often necessarily of an extremely delicate nature, theories cannot be made to rest on the broad and substantial basis of facts, and no surer means can be taken to accomplish this than to bring before the philosopher a collection of instruments emanating from scientific workshops in various countries, thus enabling him to draw valuable information from the physical labour of others, which will, when applied to arts and manufactures, contribute to the advantage of mankind generally. As the successful scientific speculations of the last three centuries have been the natural sequel to the art-energies of the preceding ages, so must the newest scientific speculations of our contemporaries and their successors, in order to be successful, be the result and consequence of powers as yet often appearing in the undeveloped form of art alone which exist among us at the present day. Thus a great exhibition of the works of material art should carry with it its scientific moral, and the opportunities of surveying a vast practical art-world, and of appreciating the probable results of its sway, may well be deemed too valuable to be allowed to be let slip for the purposes of that scientific study and speculation which naturally arise from such opportunities.

Philosophical instruments, processes depending on their use, models, &c., are represented in the Paris International Exhibition by 490 exhibitors. The countries of these exhibitors testify how philosophical science is extending over our globe. The following table will enable a comparison to be instituted between the exhibitors of philosophical instruments at the last London International Exhibition and those exhibiting in the Paris Exhibition of this year:—

	1862.	1867.		1862.	1867.
Algeria	—	3	Norway	3	7
Austria	21	20	Papal States ...	1	6
Baden	1	4	Portugal	1	3
Bavaria	3	17	Prussia	20	24
Belgium	8	7	Russia	5	18
Brazil	2	3	Siam	—	1
Canada	—	5	Spain	—	5
Denmark	4	1	Sweden	12	13
Egypt	—	10	Switzerland ...	9	14
France	62	112	Tunis	—	1
Hanover	2	—	Turkey	—	60
Hesse	2	3	United Kingdom...	162	29
Holland	10	9	United States ...	1	15
Italy	19	91	Uruguay	—	1
Liou-Kiou... ...	—	1	Wirtemberg ...	3	4
Natal	—	2		351	490
Nova Scotia ...	—	1			

It appears by the foregoing table that the total number of exhibitors in the department of philosophical instruments at the Paris Exhibition of 1867 exceeds those who exhibited in the London International Exhibition of 1862 by 139. We also find exhibitors in this class from Siam, Tunis, Liou-Kiou, Brazil; not, it is true, placing before us any very remarkable instruments or scientific models or drawings, but, still, objects which testify that the torch of science has been lighted in far distant countries, and a spirit of philosophical investigation awakened.

It will be also seen by the above table that the great increase in the aggregate number of exhibitors in the present Exhibition is sustained in the class of philosophical instruments; and the fact is the more remarkable when it is considered that the United Kingdom is represented by only twenty-nine exhibitors, whereas it sent one hundred and sixty-two to our International Exhibition of 1862.

The space at our disposal will only enable us to note the most important objects exhibited.

ASTRONOMICAL INSTRUMENTS.

The transcendent achievements of astronomical science are due in a great measure to the excellence and precision of astronomical instruments. For although the observation of the heavenly bodies has always been a favourite pursuit of philosophers, it was not until the close of the seventeenth century that great exactitude was attained in the principle and practice of observation. At that period telescopes of far higher power than had hitherto been used were brought to bear on the heavens; and they were provided with delicate micrometers, for making micrometric measurements. But, wonderful as were these instruments, compared with those used by preceding astronomers, they appear insignificant by the side of those constructed during late years for national observatories.

The great risk, however, attending the carriage of philosophical instruments, and especially large equatorials, will always cause countries to be inefficiently represented in this department at international exhibitions. Thus, the Paris Exhibition, like its London predecessor of 1862, fails to illustrate the high perfection to which the great makers of astronomical instruments have attained. Many of the most eminent makers, and especially the English, do not exhibit; and there is only one reflecting telescope in the Exhibition. This is the more to be regretted as great attention has lately been paid in the United Kingdom by eminent men of science to the improvement of the latter instrument, particularly with reference to the construction of a powerful reflector which it is proposed to set up at Melbourne for the purpose of observing the astronomical phenomena of that hemisphere.

The Royal Observatory at Greenwich and those of Oxford, Cambridge, Edinburgh, the Cape of Good Hope, Berlin, and Paris, have been largely supplied with important, and in many cases novel, instruments of great power; while the munificence and enterprise of private individuals—such as Lord Rosse, Mr. Nasmyth, and Mr. De la Rue—are continually evoking new efforts of mechanical skill, to the great advantage of astronomical science. It would, however, be unreasonable to expect to find many large astronomical instruments at an exhibition. They are always made to order, and, when finished, are forwarded to the observatories or other establishments for which they are required. An exception might have been made with respect to the astronomical and geodesical instruments of the highest excellence, constructed, under the direction of Colonel Strange, by Troughton and Simms and T. Cooke and Sons, for the use of the great trigonometrical survey of India for the determination respectively of longitude and latitude. These instruments, consisting of a great theodolite, zenith sectors, 5-ft. transit instruments, vertical circles, galvanic chronographs, and astronomical clocks, are not only remarkable for their great mechanical excellence, but also for various ingenious mechanical modifications and arrangements designed by Colonel Strange. The 5-ft. transit instrument has a very powerful telescope of 5 in. clear aperture (a very large diameter in proportion to its focal length). The axis is of aluminium bronze, cast in one piece, hollow, and turned both inside and out. All the instruments combine in a very remarkable manner maximum power with minimum weight—always highly desirable; and are, in all respects, by far the best of their kind that have been made. Under these circumstances, it is to be lamented that an application to the Secretary of State for India for permission to exhibit them in the Paris Exhibition was unsuccessful. They would have excited great admiration and reflected high credit on Colonel Strange and their makers.

One of the principal features in connection with astronomical instruments is the change that has taken place during recent years in their construction. Formerly, and the remark applies to philosophical instruments generally, there was a tendency to make them extremely heavy. The result was, undoubtedly, solidity, but this was attained at the expense of great unwieldiness. There is a very old microscope exhibited among archæological objects in the French department of the Exhibition which aptly illustrates the case in point. It is very large, very heavy and cumbrous, and yet of such low power that a modern microscope of less than one quarter its weight is far more easy of adjustment, besides being at the same time much more powerful. Mechanical skill has effected a great revolution in the metal work of instruments. All superfluous adjustments are rejected, and the greatest possible solidity is given to those retained. Lightness with great strength is attained by the use of aluminium bronze, which is now used in the construction of astronomical instruments, and would be more extensively employed if a method of obtaining sound castings with certainty could be discovered. It is but little affected by ordinary chemical agents, and possesses a strength, both tensile and transverse, exceeding that of wrought iron.

The largest equatorial exhibited is that constructed by Brunner Brothers, of Paris (89). The object-glass of this fine instrument is 8·4 in. in diameter, and it is provided with a very accurate clock movement, constructed on principles calculated to afford perfect regularity of motion without tremor. The general appearance of this instrument is elegant, while the workmanship throughout is of the highest excellence. It has been constructed, by order of the Viceroy of Egypt, for the observatory of Boulik, near Cairo.

P. G. Bardou exhibits, in the French department, a large telescope (49) with altazimuth mounting and a 9·2 in. object-glass; but the general construction of this instrument is by no means of a first-rate description.

Mr. Dallmeyer, United Kingdom (9), exhibits a 6-ft. equatorial, with 5-in. object-glass, embracing all the most recent improvements. The principal feature in this admirably-constructed instrument is that the same clock motion moves two circles, one of which shows sidereal time, while the other moves the telescope. The form of pedestal and position of the clock are such that the clock weight descends in the centre of gravity of the instrument, thus increasing the steadiness of the telescope.

M. Evrard, France (92), exhibits a large astronomical telescope, with a 9·2 in. object-glass and a horizontal and vertical motion; but, apart from the size of the object-glass, there is nothing marked in this instrument.

Secretan, France (90), exhibits a small reflecting telescope, equatorially mounted, carrying a Foucault's silvered glass speculum of 7·4 in. diameter. The construction of this instrument is admirable, and well deserves the closest examination. Although the mirror, compared to the large 6 ft. and 4 ft. specula of Lord Rosse is very small, the brilliancy and perfection of its surface gives this telescope very high power. The speculum consists of a polished surface of glass, on which a very thin coating of silver is deposited by the process of decomposing the ammonia-nitrate solution of silver by dilute tartaric acid. This mirror has been found, by various trials, to possess considerable advantages over those made with speculum metal, which are very liable to injurious flexion by their own weight. It also reflects a greater amount of light than mirrors made of speculum metal in the proportion of 92 to 65. The great brilliancy and perfection of M. Foucault's mirrors will be best appreciated by examining those exhibited near Secretan's telescope.

It is satisfactory to be able to record that the result of a trial by the jurors of the refracting astronomical telescopes is to place Mr. Dallmeyer at the head of the list. The performance, power, and definition of his equatorial surpasses that of the other astronomical telescopes. Secretan's reflector was found to be equal in power to Mr. Dallmeyer's refractor. The next in order were Brunner Brothers, Evrard, and Bardou. The glass of which Mr. Dallmeyer's object-glass is constructed was made by Messrs. Chance, of Birmingham; the glass of the object-glasses of the Paris instruments by Mr. C. Feil, of that city, who exhibits (76) several extremely fine specimens of optical glass. There are some good altazimuth and transit instruments exhibited in the French department. Those shown by M. Balbreck and Brunner Brothers (85 and 89) are particularly worthy of notice. The altazimuth instruments exhibited by the latter are applicable either to astronomical or geodesical purposes, both circles being read off by means of micrometer microscopes. The workmanship of these instruments is admirable, the conditions of rigidity with lightness having been attained in the most successful manner. F. A. Rigaud, France (94), exhibits a portable transit circle for determining both latitude and longitude. It is provided with a compensating micrometer, and is in all respects an admirably-constructed instrument. A duplicate of this fine transit circle is exhibited by Secretan (90), both instruments having been made under the superintendence of M. Villarceau, of the Paris Observatory. T. Ertel and Son, Bavaria (7), also exhibit a good meridian circle.

TELESCOPES.

The display of mounted and hand telescopes for amateur astronomers and for military, naval, and travelling purposes is very large. T. Rees, United Kingdom (22), exhibits several telescopes of excellent definition—one, for astronomical purposes, is mounted on a stand of very ingenious construction, with very convenient horizontal and vertical motion. J. H. Dallmeyer, United Kingdom (9), has been very successful in producing hand telescopes of a superior description. He exhibits some instruments the focal lengths of which are only from nine to ten times the diameter of their clear aperture. The performance of these instruments is most excellent. H. and J. Beck, United Kingdom (3), exhibit a new binocular telescope, with which some very interesting features connected with binocular vision can be observed. Bardou, France (49), exhibits a great variety of telescopes and binocular opera-glasses, some of which are mounted in aluminium. M. Bardou possesses the means of soldering this metal, which enables him to use it extensively for large hand telescopes. The low price of M. Bardou's small telescopes and opera-glasses, of which he supplies great quantities to England, is very remarkable when considered in connection with their excellent workmanship and good definition. A. Paillard, France (74), exhibits various opera-glasses which, by an ingenious contrivance, can be changed for use in the country, marine purposes, or for the theatre. P. V. Teigne, France (18); Rieder, France (60); Lebrun, France (77); Steinheil, and Merz, Bavaria (5 and 6), also exhibit good telescopes, with, in some instances, new contrivances for mounting. The opera-glasses and lenses for telescopes and photographic cameras exhibited by Voigtlander and Son, Austria (18), are excellent, and fully sustain the well-known reputation of this highly-eminent firm.

In connection with astronomical telescopes, an observing-chair, exhibited by Mr. B. Tyer, United Kingdom (28), may be noticed for its ingenious and, at the same time, simple construction.

SURVEYING INSTRUMENTS.

The show of these important instruments in the Paris Exhibition is greatly superior to that in the International Exhibition of 1862; for, though not presenting any great novelty of construction, their workmanship is better, and, with few exceptions, they display greater perfection and a much higher finish. This is especially remarkable with respect to a theodolite, constructed by G. Brauer, Russia (16), under the direction of Professor Jacobi, of St. Petersburg. This instrument, which was tested by the jurors, was found to be wonderfully accurate, and to answer all its requirements admirably. F. Drier and Co., France (25), exhibit several beautiful surveying instruments, many of which were used in the survey of Paris. They highly merit the closest examination. The leveling instruments shown by Gravet-Tavernier, and Rigaud, France (23 and 94), are excellent. The latter exhibits a theodolite made of platinum. The instruments of this description exhibited by J. Kern, Switzerland (10), have long enjoyed high reputation. Several will be found in the Paris Exhibition remarkable for their precision and very moderate price. The principal novelty they display is in their mechanical arrangements, though in the opinion of some of the jurors rigidity has been somewhat sacrificed in the endeavour to obtain lightness. The establishment of M. Kern at Aarau employs 120 workmen in the manufacture of surveying and mathematical instruments, large quantities of which are exported to England. The theodolites exhibited by Pistor and Martins, of Berlin, Prussia (6), are of the highest order of excellence, and are remarkable for a very ingenious apparatus for reversing the telescope in its bearings. The Société pour la Construction d'Instruments de Physique de Genève, Switzerland (12), also exhibit good surveying instruments, very remarkable for their moderate price. The Industrial Institution of Lisbon, Portugal (2), exhibits well-constructed theodolites, showing a great advance in excellence of workmanship over those exhibited by the same institution in 1862. Cavaliere Rossi, of Rome, well known for his admirable survey of the catacombs under that city, exhibits a stenographic and orthographic machine, which has been used with great success in the subterranean survey. "The machine is carried in the hand. A long micrometer screw has a pulley at one end; over this pulley is wound an endless cord of definite length, as, say, one yard. The operator, placing himself close to the wall to be surveyed, measures off yard by yard with his cord. The act of doing so turns the screw at each yard, a definite quantity, of which the proportion to the yard is known. The screw moves a tracer over a piece of paper fixed horizontally on the machine. The tracer has two points, which can be separated by a quantity representing the width of the path or gallery being surveyed. The vertical section is obtained by analogous means, a light being carried in advance of the observer on which to direct a pair of sights, the inclination of which determines the position of another tracer on a second piece of paper attached to the machine." Such an instrument cannot, of course, give very accurate results; but with it Cavaliere Rossi has made a very interesting survey of the catacombs.

H. Schaeffer, Grand Duchy of Hesse (2), exhibits several good theodolites and levels. The workmanship of these instruments is of a superior order, and reflects great credit on the establishment from which it emanates. Becker and Buddingh, Holland (7), also exhibit some well-constructed levels of good quality.

Under the head of surveying instruments may be included planimeters and telemeters, several varieties of which will be found in the French department of philosophical instruments. Planimeters, which, it may be remarked, are more used on the Continent than in our country, are constructed for ascertaining, without entering into trigonometrical calculations, the area embraced within any given outline traced on a plane surface. "The instrument acts on the principle of mechanical integration—that is, the summing up the small areas into which any given figure may be supposed to be divided by an indefinite number of equidistant lines, either parallel to each other or on passing through the same point, the former indicating in geometrical language rectangular and the latter polar co-ordinates. It will be easily understood that, if motion can be communicated to a rotating wheel which is jointly proportional to the number of successive lengths of the elementary portions into which the surface is supposed to be divided, the aggregate motion of the wheel multiplied by some known constant will represent the superficial area to be determined."

Telemeters, or, as the name implies, distance measurers, consist of two telescopes placed at the ends of a short base, composed of two concentric tubes containing reflecting prisms, by which the object is bisected horizontally and the images of the upper and lower halves brought before the eyes of the observer. A coincidence can be obtained by moving one of the prisms attached to a long graduated arm, the reading of which gives, by reference to a table, the required distance of the object. Specimens of both these instruments are exhibited by Gravet-Tavernier, and I. Lefebvre, France (23 and 42).

SEXTANTS.

A very fine display is made of these instruments, particularly by Paris makers. Several exhibit important modifications of the original sextant, especially in the introduction of artificial horizons for use on shore, or at sea when the sea-line is hazy. It is to be regretted that the eminent English makers of these instruments have not exhibited, for at the Exhibition of 1862 their sextants and quadrants were remarkable for excellence of construction and moderate price.

A sextant, with attached spirit-level horizon, exhibited by G. Davidson, United States (8), is worthy of examination.

The difficulty of procuring good plane and parallel glasses at a moderate price for sextants has hitherto been very great, and there exist but few artists capable of supplying with certainty and in perfection these important objects. The glass made by C. Feil, France (76), for sextants is by far the best in the Exhibition. Mr. Butters, of London, has devoted himself for many years to the manufacture of glasses for sextants, which are of the highest quality; but he, unfortunately, does not exhibit on the present occasion.

MATHEMATICAL DRAWING INSTRUMENTS.

The show of mathematical instruments in the Paris Exhibition leaves scarcely anything to be desired. They combine, in a very remarkable manner, great accuracy and high finish, with, in many instances, economical manufacture.

Elliott Brothers, United Kingdom (13), who have long been celebrated for their mathematical instruments, exhibit an extensive and most beautiful collection. Their construction and high finish cannot be surpassed. Gravet-Tavernier, France (23), and J. Kern, Switzerland (10), also exhibit excellent instruments of this description. The latter are remarkable for their very moderate price.

Darling, Browne, and Sharpe, United States (11), show an admirable series of steel measures of length, steel caliper-tubes, Vernier calipers, universal squares, centre gauges, bevel protractors, and specimens of the American wire gauge. The accuracy of their steel straight edges is very great, and the general construction of their instruments is excellent. The divisions on the scales are effected by machines, and are extremely clear and accurate. These articles are manufactured on a large scale for the engineering establishments in the United States, and also for the English market.

The mathematical instruments exhibited by J. Royer, France (69), are extremely good; one for drawing parallel lines by the action of a spring, is very ingenious. Haff Brothers, Bavaria (9), exhibit a very complete collection of mathematical instruments, displaying excellent workmanship. Their cost is extremely moderate, considering their very superior quality. A magazine case containing a beam compass, a proportional compass, six pairs of compasses of various kinds, several excellent drawing-pens, graduated rulers, sectors, and protractors, all in electrum metal, is priced £3 18s.

C. Richter, Bavaria (10), also exhibits good and moderate-priced instruments.

DIVIDING-ENGINES.

Several of these instruments may be seen in the present Exhibition. Among the best are those of L. Perreaux, France (31), who exhibits circular and straight line dividing-engines of various sizes, and, as far as they could be tested, of very great accuracy. C. A. Guillemot, France (40), also shows a dividing-engine of a novel construction, provided with an arrangement by means of which a curve exhibiting its own error can be described. The above makers also display some very delicate cathetometers, by which the distance between two points in a vertical line can be determined to 1-2000th of a millimètre (0·0002 English inch). Two cathetometers, exhibited by G. Brauer, Russia (16), made under the direction of Professor Jacobi, also merit examination. The smaller one is exquisitely finished, and is capable of measuring distances between two points with very great precision.

It is absolutely essential in the construction of these delicate instruments that the working parts should be free from tremor. This condition has been attained in the above instruments, which are decidedly the best cathetometers that have ever been exhibited.

PANTOGRAPHS.

Several pantographs, embracing in some instances new constructions, are exhibited; but the only instrument of this kind which merits special notice is that exhibited by A. Gavard, France (33). This instrument, consisting of a series of brass rods jointed together in the form of a parallelogram, so as to have perfectly free motion in a horizontal plane, is made by very ingenious and novel contrivances to produce duplicate reductions of figures, &c., not only on plain surfaces but on cylinders. By its means patterns may be drawn and engraved on copper rollers with the greatest precision, and impressions taken from them. The invention, which is highly creditable to M. Gavard, is likely to be of great benefit to the calico-printing trade.*

Under the head of pantographs may be included a microscopic writing-machine, exhibited by E. Hardy, France (91), but which falls far short in its performance of Mr. Peter's celebrated machine exhibited in 1862, with which the entire Bible may be written three times in the space of a square inch.

BALANCES.

The present Exhibition presents a large and highly-creditable display of balances of precision, principally, however, of Continental manufacture. No very notable improvement in the construction of these important instruments appears to have been introduced within the last few years; but it is observable that foreign Governments are extremely anxious to procure as standards the best possible balances from the most celebrated makers. Thus, several balances are exhibited constructed by order of Governments for cities and towns. Those exhibited by I. C. Besson and E. E. Bailly, France (4 and 86); E. Sacre, Belgium (7); and L. Reimann, G. Horn, and F. Hugershoff, Prussia (4, 8, and 12), are remarkable for their high finish and great precision. The material of the beams, except in those of very large size, is generally brass; but many of the smaller balances for laboratory purposes are made of aluminium bronze, which, on account of its great rigidity, is a material peculiarly suitable for balance beams.

MICROSCOPES.

The collection of microscopes, including binocular instruments, is remarkably fine. Certainly, within the last few years the improvements that have been made in the mechanical arrangements of microscopes have been very great, and especially by English makers. The introduction of the binocular arrangement of Mr. Wenham and that of M. Nachet, of Paris, have created a new era in the history of the microscope. Mr. Wenham's contrivance, now generally adopted, consists in intercepting one half of the pencil emerging from the object-glass by a prism placed immediately above it, the transverse section of which is a trapezium of such figure that the transmitted half pencil is made to form the usual visual angle with the undisturbed half; the surfaces of incidence and emergence being both perpendicular to the respective directions of the rays which suffer two internal reflections in passing through the prism. The object is therefore seen stereoscopically, though in somewhat exaggerated relief. Several new and important modifications of illuminating apparatus have also been recently introduced.

The microscopes exhibited by R. and J. Beck, J. H. Dallmeyer, and T. Ross, United Kingdom (3, 9, and 22), in their mechanical arrangements, means of illumination, and powerful and clear definition, leave scarcely anything to be desired. Among other novelties introduced by Messrs. Beck is that of a binocular $\frac{1}{4}$, in which the prism is fitted immediately behind the back lens of the object-glass, and which, by means of a small screw, can be adjusted so as to divert any number of rays into the second tube; by this contrivance the full field of the object-glass is obtained, and the effect of monocular and binocular visions on the same object can be readily compared. Messrs. Beck also exhibit a 1-20th object-glass, and, under the head of Apparatus for the Microscope, other important novelties. But, although the English microscopes are the best in the present Exhibition, having come out victoriously in the trial of microscopes by the jurors, the microscopes exhibited by Continental makers may be profitably studied. The greater proportion show a marked improvement over those exhibited in 1862, especially with regard to their mechanical arrangements. The microscopes exhibited by E. F. Hartnack, France (51), should be examined carefully. Their peculiarity consists in the employment of two sets of high powers, one of which is used by immersion in water, which prevents a considerable amount of colour resulting from refraction being apparent, and causes, under some circumstances, a greater amount of light to be transmitted; but M. Hartnack's object-glasses do not approach the English glasses in angular aperture. This principle of construction has not been carried out by English microscope-makers, all their objectives being corrected for the reception of rays from air.

The microscopes exhibited by Mirand et Fils, France (52), combine a polariscope, and possess many ingenious mechanical arrangements. E. Gundlach, Prussia (13), S. Merz, Bavaria (6), and La Société pour la Construction d'Instruments de Physique de Genève, Switzerland, (12), also show microscopes which should be examined for various novel mechanical arrangements.

F. A. Nobert, Prussia (14), exhibits a complete series of his celebrated test-lines, for which he received a medal in the Exhibition of 1851; and Messrs. Beck show a very comprehensive and interesting set of microscopic objects.

SPECTACLES.

The exhibition of spectacles in the French department is by far the best in the Exhibition. Those exhibited by Delabre and Co., the Société des Lunétiers, and Morey Baillet, France (34, 80), are very remarkable for their excellence and moderate price. The latter exhibits well-made spectacles, in steel frames, which are sold at 3f. the dozen. The eminent British makers of these articles who exhibited largely in 1862 are absent on the present occasion, and thus no comparison can be instituted between them and the foreign spectacle-makers. It is satisfactory to find that in the case of nearly all the best descriptions of spectacles exhibited provision has been made to enable the axis of each eye to coincide with the central spot of the lens; without this arrangement spectacles must be always more or less defective.

SPECTROSCOPES.

Since Fraunhofer's discovery that the solar spectrum is not continuous but consists of luminous spaces separated from each other by numerous dark bands, researches in the spectra of various kinds of lights have been pursued with great diligence by many eminent philosophers. It has been ascertained that all simple bodies, especially those of a metallic nature, when raised to the state of incandescent vapour emit light, which, when submitted to prismatic decomposition, does not present a continuous spectrum, but isolated bands of different colours and of different but definite degrees of refrangibility. The colours of these bright lines and their position in the spectrum are found to depend on the chemical nature of the body which emits the rays, and to be invariable for the same substance. To this method of investigation we owe the discovery of several new metals, and it has been ascertained that luminous vapours of iron, nickel, chromium, calcium, magnesium, potassium, and sodium, with some others, exist in the vicinity of the sun. In order to pursue this extremely interesting branch of physical science, which, it is confidently expected, will give us a great insight into the physical constitution of the stellar as well as of the solar photospheres, great attention has been recently paid to the construction and improvement of spectroscopes. Some remarkably fine instruments of this kind are exhibited in the present Exhibition. By far the most noteworthy is that shown by L. J. Duboscq, France (88), constructed after Steinheil's model. The beam is successively transmitted through six prisms of 60 deg., by which means the separation of the bands of the spectrum is greatly increased. By an ingenious contrivance these prisms can be easily moved in combination. It is to be regretted that a magnificent spectroscope with nine prisms, constructed by Messrs. Spencer, Browning, and Co., of London, has not been exhibited.

DIFFRACTION AND POLARISING APPARATUS.

The beautiful and highly-interesting phenomena of diffraction and polarisation have lately engaged considerable attention, and for their observation very ingenious and delicate apparatus has been constructed by English and Continental philosophical instrument makers. The ordinary chromatic phenomena of diffraction are most easily and conveniently observed by transmitting a pencil of light through a fine wire grating, or reflecting it from a polished surface on which exceedingly fine parallel and equidistant lines are ruled. They are produced by the interference of certain rays deflected from their original path by the contiguous lines. The theory of the reflection of polarised light is one of the most interesting problems in physical mathematics. Briefly, polarised light may be described as the result of the motions or rapid vibrations of a beam of ordinary light revolved in two planes at right angles to each other, which is effected by transmission through or reflection from the surfaces of various substances. When the light is thus affected it exhibits an extremely beautiful class of phenomena, known under the name of polarisation.

At the Exhibition of 1862 many ingenious contrivances were exhibited by English makers for polarising light, but the latter do not come forth in any strength in this department on the present occasion. The most complete and interesting polarising apparatus is that exhibited by L. Duboscq and Bertaud, France (88 and 58). The object of one of the instruments shown by the latter is to measure the axes of polarisation. M. Bertaud also shows hollow prisms for liquid refraction, combining a goniometer and polariscope. Several extremely ingenious ophthalmascopes are exhibited by this maker. One has been used with great success for examining the interior of the larynx, uterus, and viscera.

H. J. Soleil, France (53), contributes a variety of polarising apparatus of very ingenious construction, and also Fizeau's apparatus for exhibiting the dilatation of crystals.

C. H. Seguy and Alvergniat Brothers, France (35 and 36), also exhibit elaborate apparatus for showing the fluorescence of crystals.

HELIOSTATS.

These instruments, the principal object of which is to maintain a solar beam continuously directed to one point, may be seen to great perfection in the French department. The heliostats of Silbermann and Foucault, executed and exhibited by Duboscq, are highly remarkable for their beautiful mechanical arrangements and regularity of motion. The heliostat of M. Foucalt has lately undergone considerable improvements, and is a very perfect instrument.

ACOUSTIC INSTRUMENTS.

Various ingenious contrivances have been devised for the automatic delineation of sonorous vibration. The best apparatus for this object—and, indeed, the only apparatus of a truly philosophical nature—is that exhibited by R. Kœnig, France (87). M. Kœnig has been engaged for many years in investigating the laws of sound, and has contrived a great variety of instruments for their illustration by remarkable and striking experiments. His exhibition is certainly one of the most interesting features in the philosophical department. Besides his own apparatus, M. Kœnig exhibits that of M. Lissajous and Desains, which comprises several novelties.

L. Magrini, Italy (36), exhibits electrical apparatus for illustrating various principles of acoustics, constructed for the Royal Museum at Florence, with which he has illustrated interesting lectures in that city.

METEOROLOGICAL INSTRUMENTS.

The great attention devoted during recent years to the investigation of the laws of meteorology has naturally led to a considerable improvement of meteorological instruments. It is worthy of remark, as illustrating the development of meteorology, that at the Exhibition of 1851 the meteorological instruments were not only extremely limited in number but, with very few exceptions, totally unfitted for trustworthy meteorological observations. The result of this shortcoming was to create a new and better class of instruments; and at the Exhibition of 1862 a great number of admirable meteorological instruments were exhibited, especially by English makers. The absence of the majority of eminent London philosophical instrument makers from the present Exhibition prevents a correct estimate being formed of the improvements effected in meteorological instruments. Those exhibited, however, are amply sufficient to show the desire that exists to improve and perfect these important instruments.

By far the most remarkable meteorological apparatus is that exhibited by Padre Secchi, Papal States (1). Padre Secchi has long been known in the scientific world for his astronomical and meteorological researches. He is director of the observatory attached to the Collegio Romano, and has been engaged for many years in cultivating and teaching the physical sciences. With great labour, and deriving but little assistance from his Government, he has succeeded in constructing the best self-registering meteorological apparatus that exists. The temperature, pressure of the atmosphere, direction and force of the wind, amount of rain, and humidity are accurately recorded by means of curves traced on paper by the apparatus, which is acted upon by clockwork and voltaic currents. The apparatus has been removed from Rome, where the writer has seen it working with great regularity.

R. and J. Beck, United Kingdom (3), exhibit a new mercurial mountain barometer, of a very sensitive character and extremely portable. It has been tested at a height of 14,000 ft., and found to be very accurate.

E. H. Hammatt, United States (3), as president of the American Aëlloscope Company, exhibits, on the part of the company, a new "aëlloscope" barometer invented by Mr. H. A. Clum. The feature of this instrument is, as its name implies,* to show the powerful atmospheric vibrations which precede storms. According to the statements of the inventor, it is extremely sensitive, and requires no correction of any kind whatever. The point indicated on the dial is correct, the instrument being compensatory in every particular. The principle consists in the combination of air-gas chambers with a float connected with a mercurial column in such a manner that the chambers are acted on by the atmosphere surrounding them. But the instrument is so large and costly, varying in price from 1000 dols to 10,000 dols., that it is not likely to come into general use or to supersede ordinary mercurial barometers.

A. G. Theorell, Sweden (9), exhibits a self-registering barometrical and thermometrical apparatus of apparently ingenious construction; but, as the apparatus is not completed, and the inventor was not present to explain its action, the writer is unable to give any detailed report upon it.

Naudet and Co., France (11), exhibit a very extensive collection of aneroid barometers, of which they are the principal manufacturers in Paris. They are of various sizes, from those intended for public buildings to delicate and minute pocket instruments. Improvements have been introduced by Messrs. Naudet, which, while increasing the sensitiveness of aneroids, render them less liable to be deranged by concussion. Few philosophical instruments afford greater proof of the perfection to which workmanship has arrived than the aneroid barometer. It was first invented by Conté, better known for the drawing-chalks which bear his name, when he was appointed director of the aerostatic establishment at Meudon, founded by the first Napoleon. He was desirous to make a barometer without mercury, to be used in connection with balloons, and contrived an instrument on the principle of the present aneroid barometer, which he, however, discarded, being unable to make it sufficiently sensitive. In the hands of Vidi and others the aneroid barometer has become a most reliable instrument.

F. Richard, France (14), exhibits several barometers on the aneroid principle, but differing from Conté and Vidi's instruments in their construction. They were invented by M. Bourdon, and are based on the tendency possessed by a coiled and exhausted tube of thin metal to contract or elongate when subjected to variations of pressure. The form of tube is not circular, but a little flattened and curved inwards. The tube is exhausted of air and hermetically sealed at both ends. As the atmospheric pressure from without increases on the tube, the variations of curvature gradually change. M. Richard states that his barometers constructed on this principle are compensated, and require no correction.

A great variety of excellent thermometers are exhibited. Those made by J. L. Révérend, France (39), are particularly deserving of notice for their clear and well-cut graduations. R. and J. Beck's exhibition of thermometers, including maximum and minimum, is highly to be commended. A. D. Bache, United States (1), shows a deep-sea thermometer, of novel construction, for registering the temperature by the action of metallic bars. The instrument is used by the United States Government Coast Survey.

Several good anemometers are displayed. They are constructed for the most part on Dr. Robinson's principle, in which four hemispherical cups revolve with the pressure of the wind and give action to most of the other parts of the apparatus. The cups are found to revolve with one-third the velocity of the wind. R. and J. Beck exhibit an excellent anemometer, and those shown by G. W. Lyth, Sweden (2), and J. B Hennault and Son, Belgium (4), are to be commended for their mechanical arrangements.

Hydrometers, which form the basis of many important mercantile transactions, are abundant in the present Exhibition. Almost all countries exhibiting philosophical instruments show one or more hydrometers—the names of saccharometer, salinometer, lactometer, serinometer being applied to the purpose for which the instrument is constructed. It will be noticed that almost all the hydrometers exhibited are made of glass. They are, of course, more liable to destruction by accident, but they possess the important advantage that their indications cannot be vitiated by accident, while metallic instruments being necessarily very thin, are liable to be indented and bruised.

CALCULATING MACHINES.

Under this head the present Exhibition shows no advance over that of 1862, the few calculating machines exhibited being of a very elementary nature. These instruments are essentially of two kinds. In the simpler form the operation of addition is effected by causing a figured wheel to advance a given number of unit spaces, by moving through the same number of spaces a wheel with which it is in gear. The process of multiplication is merely that of successive additions; and subtraction and division are the inverse processes for executing the ordinary operations of arithmetic; and Leibnitz invented another by which arithmetical computations might be made. The only calculating machine in the Paris Exhibition worthy of notice is that exhibited by C. X. Thomas, France (29). This instrument multiplies eight figures by eight in eighteen seconds; divides sixteen figures by eight in twenty-four seconds; and extracts the square root of sixteen figures in ninety seconds. The price of the instrument is £20. It is to be regretted that a specimen of one of the extremely ingenious and beautiful calculating machines of Messrs. Scheutz, of Stockholm, is not in the Paris Exhibition. One of these machines is in the office of the Registrar-General in London, where it is performing very useful work. It not only calculates to sixteen places of figures, but simultaneously prints the results. Specimens of the printing executed by this machine may be seen in the Swedish department of the Exhibition.

ELECTRICAL MACHINES.

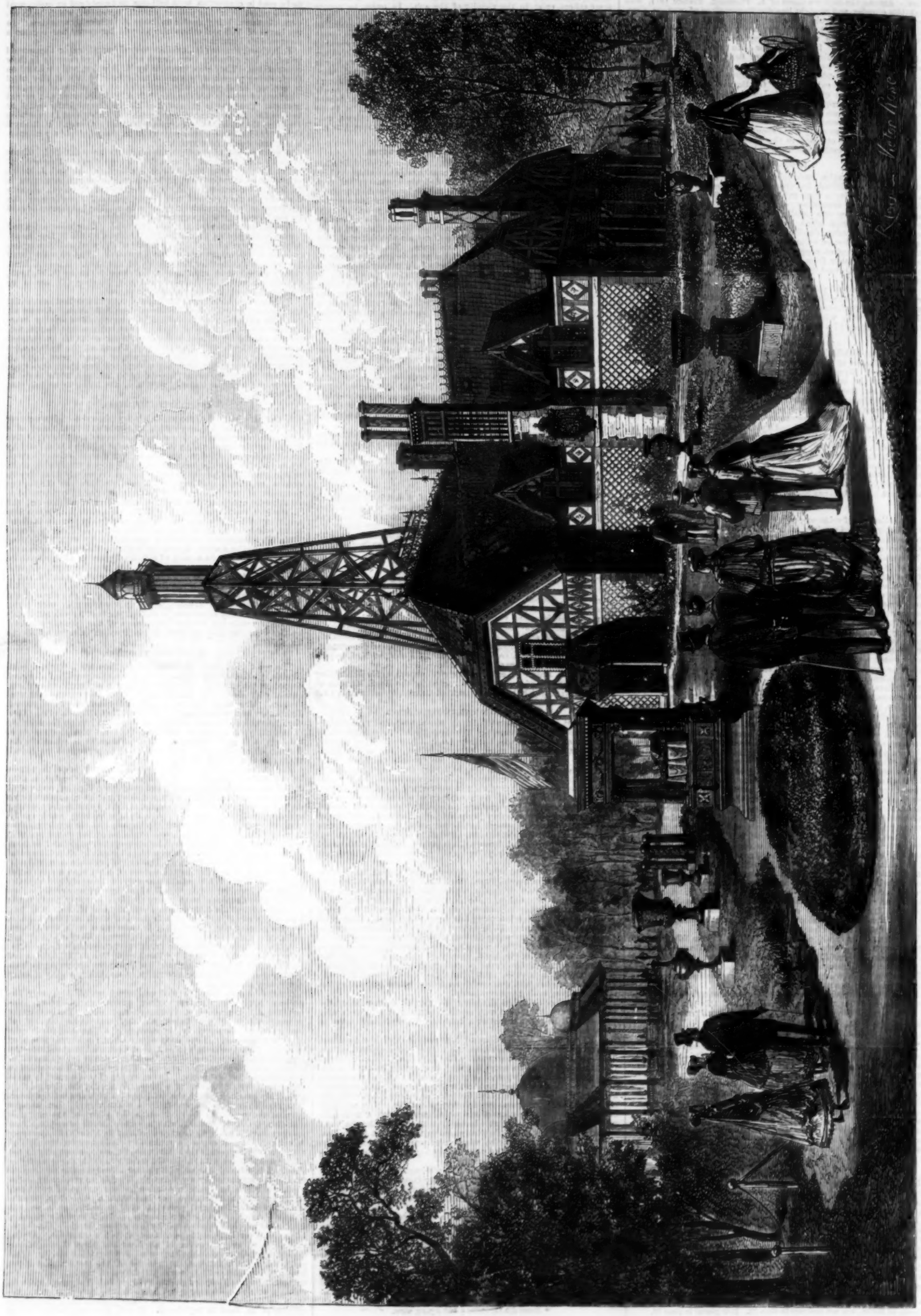
The most important philosophical instruments connected with electricity are those by which the various measurements of electrical quantities are effected. These are divided into strength of currents, quantity of electricity, electro-motive force and resistance of conductors. The most interesting electrical machine in the present Exhibition is that exhibited by M. Wesselhoft, Russia (14). It is the invention of Professor Töpler, of Riga, and acts on the principle of multiplying induction resulting from a series of glass plates rotating with great rapidity. This instrument is especially deserving of examination, and is a great improvement on Holtz's apparatus of a similar nature.

Few philosophical instruments possess greater interest than those known as electro-magnetic. From the period when Oersted, in 1820, linked the sciences of electricity and magnetism together, and proved that the one acts upon the other, not in stright lines, as other forces do, but in a direction at right angles, so that, by ultimately making and destroying the action of magnetism, a moving power can be obtained capable of mechanical application, great expectations have been entertained that these forces would admit of useful practical application. But hitherto no electro-magnetic machine has been constructed at all capable of competing successfully with the steam-engine. P. Dumoulin-Froment, France (83), exhibits a machine of this kind, but it is more in the nature of a toy than a machine of practical utility. But Oersted's discovery of these electro-magnetic laws have been turned to signal advantage for astronomical purposes. The Americans were among the first to apply these in the determination of the difference of longitude, and W. Bond and Son, United States (4), exhibit an astronomical clock and chronograph which was used for ascertaining, in connection with the Atlantic cable, the difference of longitude between Newfoundland and Valentia. France exhibits some grand magneto-electrical apparatus. That of Nollett's, exhibited by Ruhmkorff France (1), constructed for the Ecole Polytechnique, and his inductive apparatus for converting dynamic into static electricity, are especially worthy of being attentively examined.

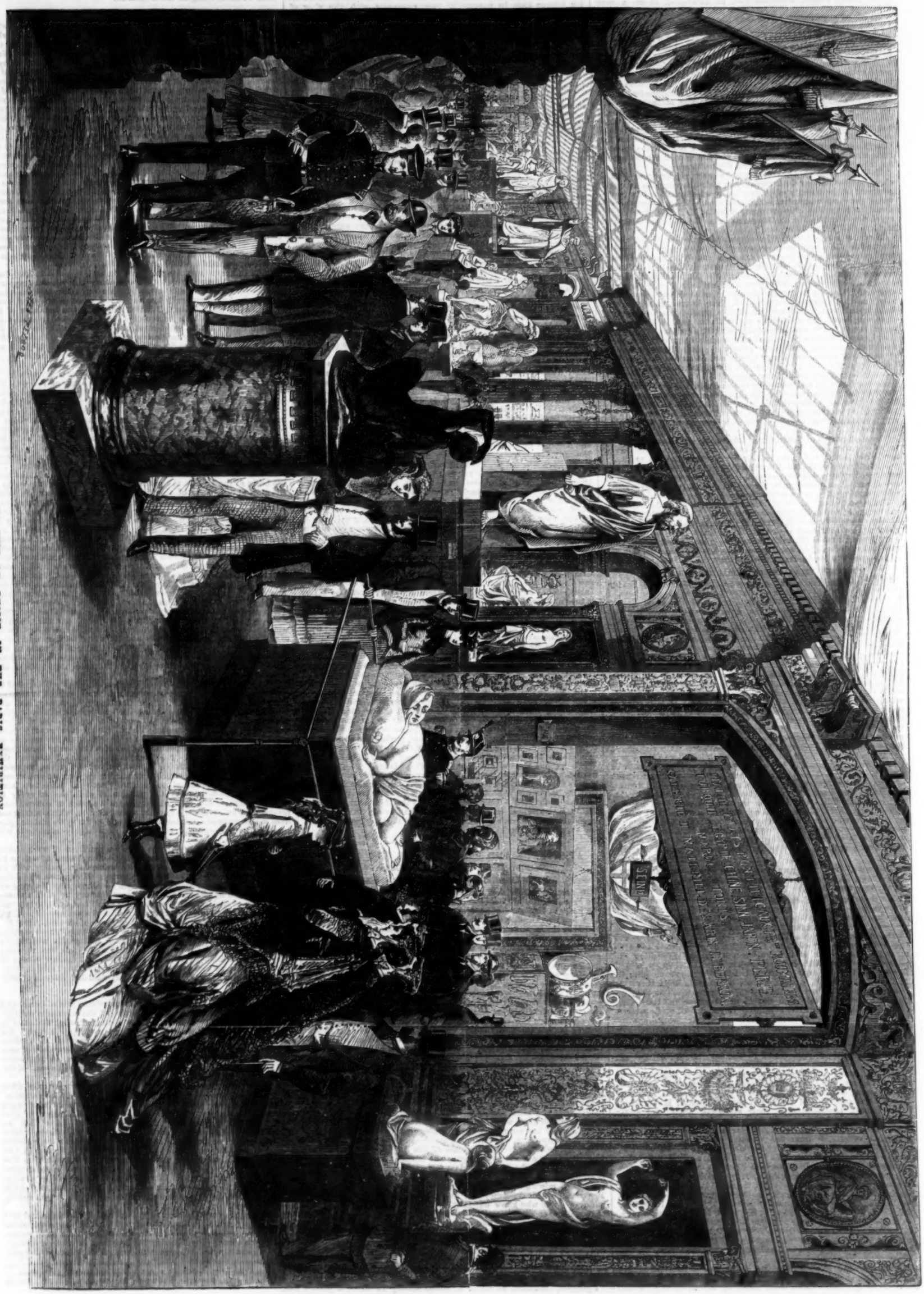
General Morin (not in the catalogue) exhibits a very ingenious apparatus for registering minute variations of temperature by means of a thermo-electric pile. The apparatus is composed of fifteen brass rods and the same number of iron ones, so disposed as to constitute a thermo-electric pile of fifteen couples. If we suppose one of the soldered points of junction of the two metals to be kept at a constant temperature—the freezing point, for instance—then, another junction being situated in a given medium at another temperature, a current will be excited in proportion to the difference. The existence of this current is made apparent by the deviation of a magnetic needle, the electric fluid previously passing through the bobbins of a common multiplicator. The needle itself is suspended by a silken thread. Let us now suppose the needle to be situated in the plane of the magnetic meridian, and to be provided with a vertical shaft proceeding from its centre and supporting a copper needle at its lower end. As copper is non-magnetic it cannot exercise any influence on the desired result, and being parallel to the iron needle, and consequently in the same vertical plane with it, it will strictly indicate the same deviations. A horizontal disc of white paper situated under this copper needle, and supported by a vertical shaft made to revolve by clock-work, completes its entire revolution in the course of one hour, being, in fact, neither more nor less than a dial-plate, which, instead of being fixed and provided with moveable hands, as in a common watch, or rather chronometer, is itself movable round a fixed hand which is represented by the copper needle. The latter has a sharp vertical needle-point fixed at its lower surface. At the expiration of every quarter of an hour the paper disc suddenly springs upwards, meets the sharp point, and is pricked by it. This mark will show what was the position of the needle at a given hour; and as this position marks the degree of the intensity of the current, which is itself but an exponent of the temperature of the medium under consideration, it follows that by this contrivance the variation of temperature which has taken place in the course of one quarter of an hour is registered. It will, of course, be understood

* It is to be regretted that a very elaborate pantograph, contrived by M. Wegner, of Berlin, was not included in class 12. It is placed in class 58.

* From ἀήλιος, storm; and σκοπεω, view.



THE ENGLISH COTTAGE AND TERRA-COTTA BOILER-HOUSE (CLASS 62) IN THE BRITISH SECTION OF THE PARK OF THE PARIS EXHIBITION.—SEE PAGE 375.



LA MUE DE RUSSIE IN THE PARIS EXHIBITION.

that the paper disc returns to its ordinary level as soon as it has received the mark of the needle. The performance of this novel and ingenious apparatus is stated to be highly satisfactory.

W. Ladd, United Kingdom (not in catalogue), shows a very ingenious electro-magnetic machine, with a new application of the principle of augmenting indefinitely the power of an electro-magnet by currents produced by itself. The apparatus can be used for light-house and other purposes, and is driven by a one-horse power steam-engine, by which force effects are produced equal to a fifty Grove's battery.

It may not be out of place to state here that electricity is likely to receive many new and important applications in the arts, one of which is the refining of sugar. While, by means of an electro-magnetic machine, a current of electricity may be made to produce its equivalent of mechanical power, so, by a reverse process, mechanical power may be made to produce electricity. It has been found by experiments that a stream of electricity derived from a powerful electro-magnetic machine driven through a solution of brown unrefined sugar will bleach it, electricity being thus made to perform the function of charcoal. It appears that one of Wilde's electro-magnetic machines, driven by a 15-horse power engine, has been set up for this object in a sugar-refinery in Whitechapel.

Under the head of electricity may be included chronoscopes and chronographs. These instruments are chiefly applied to the measurement of the velocity of projectiles by electricity, and for registering the exact moment at which an astronomical or other observation is made. The chronoscopes shown by E. Hardy, France (91), constructed for the French Government, are the best instruments of the kind in the Exhibition.

The instruments used for the automatic regulation of the carbon electrodes of electric lamps are extremely interesting. England is not represented in this department as she was in 1862; but France, in the exhibition of V. Serrin's (41) extremely beautiful and ingenious apparatus, now used in many of the French lighthouses, is admirably represented. The apparatus has been greatly improved since 1862, and the automatic regulation of the charcoal points is now under the most perfect control. The intense nature of this light is such that it has been used with great success in obtaining photographs of the catacombs under Paris, and of the sewers, specimens of which may be seen adjoining M. Serrin's exhibition.

J. Kravogl, Austria (6), exhibits the model of an electro-magnetic machine, combining some new principles; and, although not included in the catalogue, it may be desirable to state that our War Office has sent to the Exhibition Mr. Wheatstone's ingenious magneto-electric apparatus for firing guns.

An apparatus for engraving by means of electricity, exhibited in the machinery department of the Exhibition, though not included in the class of philosophical instruments, may be incidentally noticed. It is extremely ingenious, and illustrates, in a very forcible manner, the great activity of mind now devoted to utilising electricity.

The applications of electricity to telegraphy are abundantly illustrated in the Paris Exhibition, but the examples appertain to another class (64), and that of electricity to clocks to class 23.

Elliott Brothers, United Kingdom (13), exhibit Sir W. Thomson's astatic reflecting galvanometer used in laying the Atlantic telegraph cable; and P. H. Desvignes, United Kingdom, (11), a gyroscope which revolves by electro-magnetism.

There is a fine exhibition of glass tubes for showing electricity in vacuo and in various highly rarefied gases. Those exhibited by C. H. Seguy and Ruhmkorff, France (38 and 1), and by H. Geissler, Prussia (1), are the most varied and interesting.

G. Trouvé, France (8), exhibits various ingenious automatic toys, such as humming-birds, small gyroscopes, heads of animals, &c., set as pins, which move by magneto-electricity.

MISCELLANEOUS PHILOSOPHICAL INSTRUMENTS.

Under this head the following deserve notice:—Bourbouze, France (48), who shows an ingenious apparatus for determining the laws of falling bodies, their friction and rigidity; L. G. Perreaux, France (31), an ingenious instrument for ascertaining the elasticity and strength of wires; G. A. Hirn, France (16), apparatus for measuring the dynamical force of torsion in working machinery; M. Chuard, France (38), a new safety-lamp for mines; General Arbuckle, United Kingdom (2), a pyrophylax, or automatic apparatus for giving notice of a fire; C. Wheatstone, United Kingdom (not in catalogue), cryptographs for secret writing, used by the War Office; F. Wedel-Jarlsberg, Sweden (7), a self-registering compass; S. E. Morse, United States (15), a bathometer for measuring the depth of water; and a very beautiful screw-cutting lathe, exhibited by R. and J. Beck, which may be considered as perfect of its kind. It is worthy of remark that, while the precise origin of the lathe is unknown, though it may be traced to the potter's wheel of the remotest times, the plan of an extremely ingenious self-acting sawmill moved by water-power may be seen in a MS. of the thirteenth century, preserved in the Bibliotheque Imperial, Paris, and is probably of much earlier date. Turning by the lathe was long a favourite pursuit in France with amateurs of all ranks, who seem to have spared no expense in the perfection and contrivance of elaborate machinery for the production of complicated figures. This taste continued at least up to the great French Revolution, and contributed in a very high degree to the excellence of philosophical instruments. Indeed, the constructive machine most perfect in its action, whether as regards the best manner of using dynamical power or the expeditious performance and the good quality of the work done, is certainly the lathe, and great credit is due to Messrs. Beck for the improvements they have made in that devoted to screw-cutting.

COLLECTIONS, MODELS, AND DRAWINGS FOR TEACHING THE PHYSICAL, NATURAL, AND MEDICAL SCIENCES, ANATOMICAL PREPARATIONS, &c.

Under these heads the Paris Exhibition contains a vast amount and great variety of subjects. Among the most important are I. Epkens, Prussia (16), who exhibits a fine collection of models for teaching geometry, prepared under the direction of Professor Plücker, of Bonn; A. Krantz, Prussia (17), models of crystals; J. Schroeder and the Industrial Society of Hesse, Grand Duchy of Hesse (1 and 3), a magnificent collection of instruments and models for teaching the physicial sciences, geometry, and mechanics; H. Meidinger, Grand Duchy of Baden (4), models in pasteboard of various machines; G. A. Lenoir, Austria (8), various models of scientific apparatus; A. Franchini, Italy (26), instruments and apparatus for teaching the physical sciences; Central High School of Engineering, Italy (48), coloured models in wood of crystals; Royal School of Engineers, Italy (51), models of mechanical machines; workshops of Boulik, Egypt (1), instruments and models for teaching mechanics; Province of Para, Brazil (1), geometrical models in wood; E. Florck, France (62), an extremely beautiful model of a locomotive engine; J. Silbermann, France (33 and 108), oil paintings illustrating various physical phenomena; and P. Lackerbauer, France (99), water-colour drawings, and lithographs illustrative of natural history. The most remarkable natural history, botanical, and geological collections are E. Mocquery's, France (107), who exhibits a large collection of useful and noxious insects; E. Verreaux, France (110), humming-birds, their skeletons, nests, and eggs; Pattier, Climatological Society of Algiers and Icard, Algeria (1, 2, 3), plants, flowers, and seeds from Algeria; A. Krantz, Prussia (17), geological collections from the vicinity of Bonn; R. Brendel, Prussia (23), models of flowers for teaching botany; G. L. Lundqvist, Sweden (11), collection of insects found in Sweden; R. C. Schübeler, Norway (6), botanical collections from Norway; A. Strauss, Russia (12), botanical collection from the vicinity of Moscow; Academy of Sciences, St. Petersburg, Russia (15), models of aerolites which fell in Russia; A. Cerato, Italy (55), vegetable and animal fossils from Bolca and Lumezzane; Royal Technical Institution of Florence, Italy (60), geological collections from Elba; J. Sequenza, Italy (63), palæontological collections from the province of Messina; A. Sacchi, Italy (65), collections of minerals from Vesuvius; P. Parlatore, Italy (68), botanical collections and wax models of the vine disease; A. Targioni, Italy (90), zoological collections; Abdullah Bey, Turkey (12), a very remarkable and complete collection of shells, marine plants, fossils, and insects from the Bosphorus, and various preparations showing diseases of plants. These collections, extending to above 3,000 specimens, have been made by Abdullah Bey, better known in the scientific world as Karl Hammerschmidt, his original German name. He entered the Turkish army some years ago, in which he still serves as a chief medical officer. He has devoted all his leisure time to natural history, especially with the view of founding a museum in Constantinople, for which the above collections were made. But, although the Sultan has authorised the establishment of such an institution, and nominated Abdullah Bey director, the want of funds has prevented the design being carried out.

Dr. Reil, Egypt (class 12), palæontological collections from the vicinity of Cairo, and specimens of small shells (Cyprœa moneta ria) used as money in parts of Africa.

Chamber of Arts, Canada (2), stuffed birds for the study of natural history.

C. J. S. Bethune and F. Passmore, Canada (3 and 4), collections of insects and fish.

The most remarkable objects under the head of medical and anatomical preparations are those exhibited by L. Auzoux, France (98), models in wax, especially that of the human brain, showing the course of all the fibres; the muscles of a gorilla, horse, &c.; and the anatomy of various animals and structure of plants. Dr. Auzoux also exhibits the elaborate anatomical preparation, in wood, of a man, executed by the celebrated Fontana, of Florence, in 1799, by order of the first Napoleon, and for which Fontana received 80,000f. P. N. Vaseur, France (81), also shows admirably executed anatomical models, in wax and plaster-of-paris, of the human body. Dr J. Hyrtl, Austria (4), exhibits excellent anatomical models; especially deserving of attention are those showing the bony structure of the organ of hearing among animals; and A. Hartkopff, Sweden (13), exhibits delicately-executed anatomical specimens in wax, among which the structure of the gorilla is highly deserving of notice.

Dr. Brunetti, Italy (75), contributes a large collection of anatomical preparations of the human subject and of various animals, showing the structure of the organs and tissues. The *modus operandi* of the exhibitor is a secret; but in a publication on his preparations he states that the process does not occupy more than thirty hours at the utmost. The preparations are in all cases lifesize, and are unaffected by time or insects. To the student in anatomy this discovery promises to be of great use, the parts being so well preserved as to enable them to be examined microscopically. Montesinos y Capo-Justo, Spain (3), exhibits a very ingenious and well-constructed anatomical bust in plaster, and Dr. F. Schübelers, Norway (6), a fine and extensive collection of plants from that country.

The weights, measures, and coins of various countries are pretty fairly represented. The most extensive exhibition is that made by the Imperial Commission who have obtained standard specimens of the weights, measures, and coins of different nations. They will be found conveniently arranged in the pavilion in the central garden. In drawing attention to the collections under the above heads, which will be found here and elsewhere under class 12, the reporter cannot forbear from adverting to the confusion and discordancy which characterise the systems of weight and measure at present in customary use among civilised nations. Not only does the authorised system of each country (except those which have adopted the French metrical system) differ from that of every other country, but, as may be seen in the present Exhibition, particular provinces and towns, in various countries, are allowed to adopt special standards of their own. Thus, in Turkey there are above fifty different weights and measures, which may be seen in that department; and in other countries similar want of uniformity prevails. It is, indeed, greatly to be desired that this terrible and most perplexing system should be reformed. Every investigator in the field of science can bear witness to the overwhelming labour involved in the numerous and lengthy calculations necessary to reduce to a common and comparable expression results recorded under systems of weight and measurement at once numerous and inconsistent. It will, assuredly, not be one of the least important results of the Paris International Exhibition if Governments generally should be led by it to adopt the simple and admirable metrical system of France.

In conclusion, it may be stated that if the philosophical instruments in the Paris Exhibition are not remarkable for any great novelty, they are eminently so for their general excellence. They also demonstrate in a very conspicuous manner the exertions that are being made by philosophers to compel Nature, by means of self-registering instruments, to record her own facts. Mr. Charles Brooke's admirable and beautiful system for the photographic self-registration of natural phenomena has been extensively adopted with signal advantage to science; and, while in long past ages man knew no substitute for the replacement of manual exertions, scientific agencies are now called into play which, while greatly diminishing labour, largely add to the comfort and prosperity of the commonwealth. But while the labours of our philosophers in this department of science are great, it is to be regretted that more attention is not paid to the construction of models and instruments for technological instruction in general, with the view to their being exhibited in the principal cities and towns of the United Kingdom. While various Continental countries exhibit largely in this most important department, the United Kingdom is scarcely represented. This is the more to be lamented, because it is abundantly evident that the numerous schools and collections for teaching the natural sciences established during recent years on the Continent have been highly instrumental in developing and improving the arts and manufactures of foreign countries, which now in many respects rival, and even surpass, our own.

APPARATUS AND PROCESSES OF THE ART OF MINING AND OF METALLURGY.—Class 47.

BY WARINGTON W. SMYTH, M.A., F.R.S.

The peculiar subdivision and classification of subjects adopted by the French Imperial Commission have introduced into the work of the juries in 1867 sundry anomalies which would have been avoided by a less transcendental system. At our own Exhibitions of 1851 and 1862 the apparatus and the products of the arts of mining and metallurgy were conveniently classed together; whilst on the present occasion the miner and metallurgist found his raw materials and his products (in class 40) entirely cut off from the processes and implements by which he is accustomed to work them, and the two divisions severally grouped with other classes, which in the real conduct of his business have no connection whatever with his own pursuits. This inconvenience could only be partially remedied by arrangements made by the secretaries of juries to pass certain of the objects exhibited from one class to another. In this manner the geological maps and sections, which ought to be regarded as the records of the exploratory labour upon which the work of the miner is to be based, were placed, in the building and by the catalogue, in class 13, along with ordinary geographical maps, but were claimed for consideration by class 40; whilst those which were on a scale detailed enough for being applied directly to the purposes of mining were taken up, along with models of mining localities, into the department of class 47. Similarly, it was agreed between the secretaries that the refractory substances, including plumbago or graphite crucibles, firebricks, &c., several groups of which had been exhibited in our class, should be transferred for the consideration of the jury which dealt with materials of construction in general, and which already had ranged under its numbers a long list of exhibitors of bricks, terra-cotta, and refractory materials.

In what belonged properly to class 47 the English portion of the Exhibition was exceedingly meagre; and neither alone, nor taken in conjunction with the display in class 40 (minerals and metals), could it pretend in the remotest degree to represent the greatness and the activity of mining and metallurgical life in the United Kingdom. The causes of this deficiency will readily suggest themselves to the minds of those who know our English works, and need, I think, no examination or discussion in these pages. But it is of the highest importance that, whilst our own producers decline so generally, from one cause or another, to enter the lists, we should inquire whether they can properly repose at a distance in fancied security, enwrapped in an atmosphere of self-satisfied superiority, or whether they ought not to be on the *qui vive* and preparing for fresh efforts, on seeing the examples which appear to mark an extraordinary degree of advancement on the part of our foreign competitors.

I propose, therefore, to invite attention chiefly to those objects which are likely to excite the interest of our own masters, overlookers, and workmen, in comparing what we know at home with that which is doing on the Continent.

MODELS AND PLANS OF MINING LOCALITIES.

Some of the most remarkable works of this class are those which illustrate the complicated structure of that important coal-field which extends from the Belgian frontier through the Department du Nord and far into the Pas de Calais. The French Ministry of Public Works has exhibited the map (on a scale of 1 to 25,000) constructed by M. Dormoy, with sections attached to it taken across the breadth of the trough, and showing the position and thickness of the troublesome overlying bed of watery ground called the *torrent*. The map of the Pas de Calais, drawn up by M. Coince, is perhaps still more noticeable, as showing on a larger scale (1 to 10,000) the energy and system with which, by means of an elaborate series of borings, all of them accurately recorded, the development of a valuable new coal-field has been accomplished within a very few years. It was only in 1846 that a boring for water at Oignies, not far from Douai, gave evidence of the continuation of the coal measures beneath the cretaceous strata in this direction. The borings of the Escarpelle Company proved, as was pointed out by M. Du Souich, that the coal formation was sharply deflected north-westward from its old direction at Valenciennes; and hence arose, between 1850 and 1864, the establishment of nineteen new concessions, seventeen of which are in the Pas de Calais, and extend within that department over a length of about thirty-five miles. Some forty pits have already been sunk, having, on an average, 100 to 150 metres of overlying formations to pierce, and down to depths of from 180 to 300 metres for their workings.* The amount annually produced from this new and unseen district of coal has increased steadily from less than 500 tons in 1851 to upwards of 1,600,000 tons in 1866.

Plans of a most accurate character, on the scale of 1 to 5000, have been prepared from the elaborate surveys of M. Grüner to represent the conditions of the still more valuable but old-established coal-field of the Loire, generally known by the name of its chief town, St. Etienne; and a beautiful model, founded upon the maps of the same engineer, has been constructed by M. Leseure, to exhibit the singular curves of the great seam of Rive-de-Gier in the same district. This so-called *grande masse*, varying from 26 ft. to above 50 ft. in thickness, has been so far explored as to enable all its folds and faults and other accidents to be shown with great minuteness, the small portions which are still uncertain being left blank.

The works thus emanating from the Ministry teach us a useful lesson in connection with the commercial history of France. Not even the rich and advantageously situated beds of Rive-de-Gier could be worked with profit so long as insufficient capital and a low state of technical knowledge prevailed. The hampering of the coal-miners with the claims of surface owners, the undue subdivision of the ground, and the inattention of the Government to the treatment of what was truly a large question, had, between 1832 and 1838, brought the district to the verge of ruin. Most of the collieries were losing money, numbers of them were being successively drowned out, and the prospects of the future were miserably neglected. The present large annual production of over three millions of tons from the basin of the Loire, and the clear light which is now thrown upon the natural conditions of the district, testify to the new life introduced within the last seventeen years by an improved organisation.

Another representation of the surprising progress made by France within a single generation is exhibited by the mining company of the Grand Combe (6, 19, and 31, France). Few, perhaps, of our countrymen who throng in numbers to Nismes and Aviguon are aware that, in those wild and storm-ravaged hills above Alais, the perseverance of the "industriels" has opened out a coal-field which promises to be a most important treasure to the south of France, and is already third on the list of the French coal-districts for its amount of production.† The ravine of the Grand Combe is the locality of the most active mining operations; and a very large model, showing all the plications and disturbances to which the basin of coal has been subjected, proves, at the same time, the great amount of exploration done within a few years, and the care with which all ascertained data are recorded. Plans, sections, and books of statistics, beautifully kept, are added for the further elucidation of the subject; and one point of especial interest to some of our English coal-workers will be found in the extension, in several places, of the coal-workings far beneath the overlying strata of the Trias.

Several other special localities have been admirably illustrated in the same manner, as the curious seam of coal worked at Creusot (Saône-et-Loire), the mines of the Commentry Company, and the iron-mines of Ranclé. But, among them all, none are more worthy of observation than the plans of part of the coal-basin of Liège, executed by M. van Scherpenzeel Thim. By means of exact vertical sections which he has constructed for that field, to the number of 700, he has laid down the precise position of all the seams throughout a slice of the coal-field of 50 metres deep, selected between the horizons of 140 and 190 metres below the level of the sea, as being that portion of the basin which is of the highest present importance in laying out the practical operations. Between these two horizontal planes he determines the position of each bed at every 10 metres of depth; and, by a shading upon a system of conventional perspective, he has given a graphic representation, which, aiding the lines mathematically determined, presents to the eye a distinct picture of the underground relations of this highly-contorted but valuable region.

These various labours testify to the close exactness of work and to the intelligence of the French and Belgian engineers, as well as to the careful spirit of their respective Governments in dealing with so important an element of national prosperity. How much would the labours of our recently-appointed Royal Commission of Inquiry on Coal have been lightened and rendered satisfactory had similar documents been available in our own coal-fields, and had a similar precaution been exercised in registering the results of sinkings and borings, which upon our careless want of system are so often totally lost?

The excellent plans and sections in which the Prussians have recorded their important explorations of Westphalia and Silesia come rather under the head of geological maps, and were reported on at the Exhibition of 1862; but they are not the less worthy of attention from visitors who desire to understand the rapid development of the mineral wealth of these highly valuable districts of coal.

WORKING OF MINES.

The laying out of the general plan of operations in coal-mines and the methods adopted for the actual getting of the mineral constitute a subject too extensive to be otherwise than partially illustrated in an exhibition. But, considering how such a subject involves the pecuniary economy of obtaining this mainspring of all modern industry as well as the security of the hundreds of thousands of men who toil in what is necessarily a dangerous vocation, we may refer with advantage to a few contributions which tell us somewhat of the processes used in France and Prussia.

The days are quite past and gone when the coal-workings of these countries were petty and incomplete, and commonly feeble imitations of English originals. The great annual amounts now raised by them—12,000,000 tons by France, and 23,000,000 tons of coal and brown coal together by Prussia—suffice to show that an enormous trade has arisen, and that an experience has been gained both by directors and workmen which has led to much independence of design and process. It has not been without difficulty that so considerable a development has been brought about within so few years, especially in the bringing up of a large population competent to deal with a new task; and in certain districts particularly, as in the department du Gard, the mining companies have had to take in hand all the details of social organisation, as if planting a colony in a desert land.

It may not be generally known that the coal-fields of Central and Southern France, although individually of small extent as compared with our own, are remarkable for the occurrence of seams of extraordinary thickness. The tolerably regular beds of coal at Blanzy and Montceau run to 50 ft. and even 60 ft. thick; that of Creusot,

* One pit—that of Ferfay—has its workings at the depth of 460 metres.

† The yearly production of the coal-field of the *Gard* is now above 1,200,000 tons.

where it is raised up into a vertical position, varies from a few feet to 50 ft., 80 ft., and as much as 130 ft., measured right across; and the great seam of Decazeville (Aveyron) often extends to 100 ft. in thickness. Their very magnitude, to say nothing of their often distorted position, entails on the workers a variety of difficulties, which it has taken a great number of years successfully to surmount. One method after another has been tried, and many successive improvements have been introduced, chiefly tending to guard against crush and creep, alike destructive to the getting of coal of fair size and dangerous to the life and limb of the workmen. At last, by common consent, it is allowed that the only full and satisfactory method of getting the largest quantity of coal and of ensuring safety to the men is that of systematic "packing" or "stowing" of all their bords, stalls, or gobs—of all excavated places, in fact, except the needful roads—with rubbish (*remblais*), carried down from the surface for that purpose. A night shift of men, the *remblayeurs*, are occupied with this task whilst the colliers are absent from the mine; and in some districts a particular shaft and line of roads and special waggons or tubs are set apart for the work. I am glad to be able to bear witness, from inspection at Montceau and at St. Etienne, how methodically the complete packing is carried out, and how it forms a surprisingly-good roof to work under when the next stage below it is attacked. It would be out of place here to enter into the details of the arrangements under which this process is securely followed; but the large block model of the Creusot collieries may be mentioned as showing very fully the curiously irregular position of one of these seams; and the model in the midst of the iron productions of Commentry as illustrating the means of working away the successive horizontal ranges of the thick coal-bed of that locality, by the aid of a close packing. A question of this kind can only be fairly judged by reference to the figures obtained from actual experience, which tell of its relative economy. A great expense is undoubtedly incurred; for we believe that, in some pits, as many as one third of the men are engaged as *remblayeurs*. But it would appear that, considering the saving in timber, in round coal, and the comparative immunity from accidents, the French engineers have reason to be satisfied with a system which is the growth of many years of study and practical trial.

It is notorious that a chief reason of the inability of the French ironmasters to rival in cheapness their English competitors is the considerably higher price which they have to pay for coal. The reasons for this are manifold. Whether timber propping or stone packing is employed in the pits, it is necessarily in much larger proportion than in our more favourably-conditioned English and Welsh coal-seams. A French collier, as a general rule, can only get in a day's work from half to four fifths of what an English hewer will break down. It is only in the pillar-working (*dépilage*) of the thick seams that the French workman obtains an advantage and can get as much as six or seven tons in the day; but for this task he needs a special skill and experience, and earns a much higher wage than the average.*

Owing, again, to the irregularity of the seams, a far larger comparative cost falls to the item of dead-work; and for the same reason the underground transit remains generally on a very inferior footing to that of our first-rate British collieries. Moreover, the total number of people employed about a coal-pit in France has to be exceptionally large for a given out-put of mineral, in consequence of the general need for carefully cleaning or washing the coal. It is thus only marvellous that, considering how a numerous working population has had to be educated to a peculiar class of labour, the amount of coal raised in France has risen from 1,800,000 tons in 1830, to close upon 12,000,000 tons in 1865. The high civilisation of the country needs, however, a much larger amount, and the importations of 1865, chiefly from Belgium, amounted in coal and coke to about 7,100,000 tons besides.

Up to the advent of railways our neighbours across the Channel had, in fact, developed their coal-fields to a very trifling extent, and their knowledge of the practical art of mining stood at a low point; but since that period the general advancement of trade and manufacture has been kept pace with by the opening of new means of transit, by the association of capital in large companies, and by the constant improvement of the methods and apparatus of working. As far as I have had the opportunity of forming an opinion, the working colliers are generally inferior to our own in working energy, but superior in steadiness; and a great part of the credit for the present active and intelligent conduct of the French coal trade is due to the excellent technical training received by the superior officers and managers at the schools at Paris, and so usefully afforded, in a different degree, to the class from which the sub-officers are taken, by the local mining schools of St. Etienne and Alais.

The Prussian authorities have exhibited several instructive models, representing their methods of excavating the seams of more moderate thickness in the Sarrebrück coal-field—pillar workings as well as a variety of long-wall, some following the level course, others the rise of the strata. Another representation of particular interest shows the removal, in one working, at the Königs Grube, Upper Silesia, of the Sattel-flötz, a seam about 24 ft. thick. The bords or stalls are driven 15 ft. wide, with pillars of 20 ft. between them; and the getting of the upper part of the seam is aided by the use of door-frame sets of timber of great height, which would entail heavy expense, unless a large portion of them can be recovered.

By no means the least interesting part of the Exhibition, in connection with the daily life of the French colliers, is the indication offered by some of the largest colliery companies of the efforts made to improve the moral and material condition of their workpeople. Anzin, near Valenciennes, exhibits models and a series of plans of colliers' houses built by the company; and Blanzy (Saône-et-Loire) has erected in the grounds a full-sized house, of a pattern largely adopted in that district. Some years ago the French coal-proprietors adopted the plan of building barracks near their pits, in which a number of people could be lodged on a small area; but the pitmen have shown so decided a preference for independent houses, and, if possible, for a bit of garden, that during the last thirty years pit villages of a very superior kind have been formed. It has been a prime object to attach the men to their localities by giving them comfortable cottages at a nominal rent, infant schools and primary schools for their children, and a pension † when incapacitated for work; whilst it has also been sought to remove, as far as possible, the temptation of public-houses, which in Belgium and in many places nearer home are a perfect curse to the working collier, and keep him in poverty, notwithstanding his good wages. The outcrop of the coal measures near Blanzy and Montceau is dotted with several colliery villages overlooking a pretty valley. The houses are mostly two and two, surrounded by garden and court, each man having about 160 square yards of ground allotted him. Some of the miners, of a provident disposition, aspire to plots of land and to building houses of their own. The company has, therefore, purchased a tract upon which it grants building lots, and advances money to its workmen for building purposes, charging them no interest as long as they are engaged in the mines. The scheme has been attended by considerable success; and the rising village of Bois-Roulot, if not as regular and as well arranged in some respects as those built by the company, is, at all events, a serviceable means of lodging a tolerably large population, and a testimony to the steadiness of the men.

Within the last few years careful experiments, conducted by the Administration, have proved, what was long doubted, that France possesses coals excellently adapted for sea service; and for some time past no other than French coal has been used in the Imperial navy. But for these purposes the fossil fuels from different localities have to be judiciously selected and mingled in certain proportions. Taking the coal as a whole, it is noticeable that it makes much more small and dust than our own, and is more frequently apt to be "dirty" or mixed with shale and clay. It hence results that the French coalmasters have been driven to pay a special attention to methods of cleaning their produce and utilising the "slack," *menu*, or small coal. At the Great Exhibition in 1851 Bérard's coal-washing machine came before us as a novelty, although it was only in certain details that it could rightly be so considered; and, besides several contrivances for that purpose introduced more recently, a great variety of ingenious apparatus has been brought into use for making "patent fuel," *agglomérés*—i.e., for pressing the small coal into cakes of various form by the aid of a small amount of some binding material. These *briquettes* are highly reported upon for naval use; in their carriage to the ports there is a loss of only 1 per cent, against from 6 to 10 per cent on lump coal; and when stored abroad they are found after two years' exposure scarcely at all injured, whilst ordinary coal would have suffered to the extent of 50 per cent. Moreover, they are very free from ash, and may be made of a mixture of flaming and of dry coal, or of those varieties which have a more free-burning and a more calorific property respectively, in such a ratio as to give the best effect in getting up and maintaining steam. The present Exposition abounds with examples of the machinery and the products of this manufacture; and, although we are not in Great Britain without a similar industry, attention may fairly be called to the subject in the interest of the millions of tons of small coal and of inferior qualities which we are every year actually getting rid of as refuse.

As early as 1833 Messrs. Marsais and Ferrand took out a patent for this purpose, but it was not until 1843 that the agglomerated coal began to be produced in any quantity, and some years more elapsed before the machinery was so far improved by several different engineers as to lead to the present large scale of the manufacture. The St. Etienne Company exhibit a model of their apparatus as employed at Givors, where, by introducing an enormous hydraulic pressure, they need only to add 5½ per cent of pitch (*brai sec*) to solidify the mass. The stack of rectangular blocks left outside the St. Etienne shed in the "park" throughout the heavy rains of April gave good testimony to the thorough compactness and durability which had been thus attained.

The greater part of the French makers appear to have adopted the circular arrangement of the Messrs. Revollier, and of Mr. Evrard and M. Dehaynin. A beautifully finished model is exhibited by the company of La Chazotte (M. Max Evrard, engineer), having sixteen cylinders disposed as the radii of a circle, in which the slack, after being heated by a current of steam and mingled by very ingenious apparatus with the pitch, is pressed by pistons and formed either into cylindrical or hexagonal blocks of convenient length. The rate of production appears to be in practice ten tons per hour with one machine (of which La Chazotte works four), requiring an engine of 50-horse power to work it, and the extreme limit of pressure being 100 atmospheres.

The prices of the St. Etienne compressed fuel are high; the first quality, which contains only 2·10 per cent of ash, is marked at 23f. per ton; the second, with 5 per cent, at 26f.; whilst the best block coal rules at from 19f. to 23½f., and the small at 9½f. to 15½f. The very small proportion of gas tar or pitchy matter introduced into the mass at this work can scarcely be considered as a general guide, since different qualities of coal will need some more and some less of binding material.

M. Felix Dehaynin, a producer of no less than 175,000 tons of *agglomérés* in the year, exhibits (in class 40) drawings of the Evrard machine as modified by himself and employed at his three works, in which 500 people are engaged. The company called the "Océan," at Paris, are also exhibitors of drawings and of the apparatus for the same purpose known by the name of its inventor, M. Mazeline.

As an adjunct in these operations, an ingenious machine by Hanrez and Co. (Belgium, 12) may be noticed. It is constructed for the drying of small washed coal by the revolution of a screw within a revolving perforated cylinder, and is stated to dry five tons per hour.

We could wish that coalworkers, mineral landowners, and capitalists would note these various indications of what is becoming in France an important trade. Without being unmindful that several companies have been established in South Wales and elsewhere for a similar manufacture, we cannot but be conscious that their action is but an infinitesimal set-off against the wholesale waste of slack that takes place in this country. It is not only that the small coal cut and broken from the saleable part of seams is in most of our districts thrown into goaf and gob by the tens of thousands of tons, but those portions of beds, often some feet in thickness, which are intermixed with stone or "sulphur," or which make a larger than usual proportion of slack, are at once rejected as useless, and acres of such coal are abandoned to be inextricably mixed up with broken roof and heaving floor, although of no worse quality than would be turned to advantage in many a French colliery. It is impossible in the hard competition of the times to blame individuals for this sin against the economical use of Nature's gifts; but it is a discredit to the country at large, and will, among our descendants, entail many an anathema on the selfish stupidity of their forefathers.

BORING, ROCK-DRILLING, AND COAL-CUTTING MACHINES.

All the world has heard of the artesian well of Grenelle; not many among the general public are aware of the striking success of the still deeper well of Passy, and but few are acquainted with the fact that at the present moment two undertakings of the same kind, on the grandest scale, are in course of execution—one in the suburb of the Chapelle, in the extreme north of Paris, by Messrs. Degousée and Laurent; the other at the Butte aux Cailles, in the extreme south of the city, by Messrs. Dru (formerly Mulot and Dru). These two firms, both noted for a great number of successful borings, exhibit an interesting assortment (57 and 58, France) of the apparatus which they employ for holes of diameters varying from 4 in. up to more than 5 ft.

The experience already acquired in supplying a portion of the French metropolis with excellent water tapped from that great reservoir in the strata of the green sand, hundreds of yards below the surface, has led the authorities to contract with thorough confidence for a further supply from the same bountiful source, and to commence the operations on a larger scale than before. In the absence of any great work of the same kind in London, we may remind those interested in hydraulic engineering of some of the chief features of the boreholes already executed *;—Height of surface above the level of the sea at Grenelle, 121·3 ft. English; at Passy, 305·2 ft.; depth of borehole at Grenelle, 1800·7 ft.; at Passy, 1923·7 ft.; internal diameter of tube, or lining of hole, at Grenelle, approximately, 9 in. to 6 in. at bottom; at Passy, 2·4 ft. The full diameter of the Passy borehole was 1 metre, or 3·28 ft. English; the new ones are to be, in one case above 5 ft., in the other about 4 ft.; whilst it is proposed to pierce, not only to the water-bearing stratum, or *nappe*, already proved to exist, but to a considerably greater depth, in order to cut other feeders which probably abound in the subjacent measures.

It is a pleasure to be able to testify to the scientific knowledge and the business-like method which are applied to their task by the conductors of these two interesting operations. Both are alike in some general respects, such as the use of rigid rods only, in preference to rope; the employment of steam to work the rods; and the erection of a lofty pulley-frame, or derrick (*chèvre*), in one case 52 ft., in the other 68 ft., high from the ground to the axis of the main pulley. But in the details considerable variations are noticeable. The free-fall cutter, for the use of which these eminent bore-masters are strong advocates, is made to detach itself by a different device, the movement is differently communicated from the steam-cylinder to the walking beam, and there are sundry other variations worthy of study. At the time the British juror and his deputy were courteously met on the spot by Messrs. Dégousée and Laurent the work was unavoidably standing; but various of the implements were put together and lowered and raised to show the facility with which the heavy weights are dealt with. Engineers who visit the Exhibition only will be able to form some opinion of the nature of the work on seeing the great tower-like tube of riveted iron plates, 1 centimetre thick each, but doubled, which forms a tall, black background to the well-arranged group of tools and models in the gallery of machinery.

At Messrs. Dru's borehole the depth, at the end of April, was near upon 500 ft.; the depth cut in the last working day, in chalk and flint, was 94 centimetres. The weight of the boring tool is above 2 tons 18 cwt. The rods are for the most part of wood, with iron connections; and a length of 20 metres, consisting of two rods of 10 metres each, is raised or lowered at a time.

The magnitude of these operations for artesian wells is greatly exceeded as regards diameter, and therefore weight of apparatus, by the remarkable boring of actual shafts, which has in several cases been successfully completed by Herr Kind. It is matter of notoriety that the sinking of deep pits through difficult ground is, upon the ordinary and even most improved system, a wearisome and expensive task. In the North French coal-field it is estimated by Burat that a capital of £120,000 is expended in the opening of a colliery fitted to raise 100,000 tons per annum, and the examples of Douchy and Aniche were cited, in each of which a still larger proportion of capital has been laid out. A serious part of this, amounting roughly to about half, is due to the sinking and fitting of the pits. And we know that, in consequence of the difficulty of piercing through the strata overlying the coal in Durham, sums of £40,000, £60,000, and, it is even said, £100,000, have been expended on a single shaft. We have now, for the future, when so much of our most accessible coal has been exhausted, in a great measure to look to workings further in "the deep" for further supplies, and to shafts sunk through greater depths of Permian and other superjacent formations; and with us, as on the Continent, the problem of sinking with more rapidity and economy is one of the highest moment. We would therefore point to No. 53, France, as well deserving of the gold medal which was awarded by the jury, and of careful attention from colliery viewers. The coal company of St. Avold and L'Hôpital (Moselle) have under that number exhibited diagrams of the results at which they have arrived, and some of the actual apparatus employed in the sinking of pits through a great thickness of watery new red sandstone which overlies the coal measures. The system, we should premise, is not altogether new. Some years ago both Kind and Mulot had undertaken to *bore* shafts of diameters of from 10 ft. to 16 ft., through ground whose "running" nature, like quicksand, prevented the application of the usual modes of pumping out the water and establishing the casing, technically called a tubbing, based on firm and water-tight strata. The excavation was therefore carried on by the borer *à niveau plein*, or with the shaft full of water; and the chief difficulty lay in the jointing, at last, of the iron or wooden lining with the firm ground at the bottom. M. Chaudron, a Belgian engineer, devised for this purpose a sliding piece at the bottom of the tubbing (the whole of which is gradually lowered as the excavation proceeds), on the bottom flange of which, turned outward, is a packing of moss, *boîte à mousse*; and, when this latter comes to rest on the seat cut for it by the boring tool, the tower of tubbing, hitherto suspended from above, rests by a corresponding flange on the moss, and so squeezes it together and against the side of the pit as to make a tight joint, after the completion of which the water can be pumped out and the sinking commenced in the common way. Such is the bare outline of the method. Concrete (*béton*) may have to be run in behind the tubbing and many other modifications adopted for insuring a perfect separation between the water in the pit and the world of waters outside.

Already, in 1860, a signal success was attained by M. Chaudron in sinking an air-shaft at Péronnes, where the watery beds had extended from the 43rd metre to 105 metres deep; and M. de Vaux, Inspector-General under the Belgian Government, reported in 1861 that the work was executed for less than a quarter of what it would have cost under the ordinary method.

A very ingenious addition of M. Chaudron's is a shield or diaphragm of sheet-iron temporarily fixed near the bottom of the tubbing and having a large pipe or equilibrium-tube in the centre, in which the water can rise, and through which the boring-rod passes down, having expanding arms which open out below the shield and excavate the ground. By this means the weight of the tubbing, which at Péronnes was about eighty-eight tons, was so balanced as to throw only about nineteen tons upon the rods employed for its suspension.

At St. Avold two pits have been thus triumphantly sunk, of which the sections are exhibited. No. 11 pit was sunk through 426 ft. of permeable red sandstone, *grès vosgien*; the final wedging-curb was fixed at 523 ft. deep, on May 1, 1866, and coal was found on April 4 last at 1036 ft. The second pit (No. 12) was so far complete that the "moss-box" was successfully laid, on Feb. 3 last, at the depth of 521 ft.

The large models of the tubbing and shield, with the gigantic boring-cutters (*trépans*) of above 13 ft. across, will support this slight sketch in calling attention to an innovation which has been attended with a high degree of practical success, and which may hereafter facilitate the development of untold wealth.

Whilst for years past the vertical boring of deep holes, *sondage*, has been aided by the application of steam machinery, numerous inventors in all countries have attempted to solve the problem of applying the same power to supersede hand labour in the miner's daily task of boring holes for firing charges of gunpowder. The common operation, indeed, of drilling by borer and hammer small holes of from 18 in. to 3 ft. deep, by which at present all our hard rocks have to be blasted, is exceedingly laborious, slow, and expensive. Those engineers who have attempted to ignore the value of powder, and to cut the hard stone bodily away, have always failed lamentably. Others have endeavoured to imitate the action of the present hand borers or drills; but the attempts hitherto made in this country to introduce the apparatus into mines have resulted only in delay and disappointment. There are, however, now in the Paris Exhibition two or three inventions which have passed the ordeal of practice, and have actually been employed in the daily service of mines. Since M. Sommeiller's successful application of single borers, each driven from its own cylinder by compressed air acting on a piston, a number of modifications of his general arrangement have been proposed, and it is to some of these that the attention of miners may be specially invited.

Mr. Doering, of Ruhrort, in Westphalia, mounts his machine on a horizontal arm projecting from a heavy iron carriage, which can be run to and fro on the rails in the level or gallery. The machine itself, consisting of a double-acting cylinder with piston, is, by means of pivoting and the motion of the horizontal arm up and down a vertical standard, capable of being set in any direction and at any height required. The drill, or borer, is attached by a key to the piston-rod, and is then by the action of compressed air projected and withdrawn several hundred times a minute against and from the surface of the rock, being turned through a small angle after every blow. A jet of water is constantly squirting into the hole for the removal of the débris, and so forcible and rapid is the action that I have seen several inches thus bored into a block of hard granite in five minutes. The bit, or cutting edge, of the tool may be varied; but the reversed Z shape, thus Ƶ, as at Mont Cenis, is preferred, and it is found that it is blunted far less rapidly than when worked by hand with the blow of a mallet. And now for its practical application. One of the jurors, M. Max Braun, director of the great zinc-mines of Moresnet, near Aix-la-Chapelle, under the Vieille Montagne Company, stated to us that eleven of these machines, three of them on the newer construction, have been in actual use there; and that in a level in strong dolomitic rock, where they used to drive by hand-labour one metre and a half in fourteen days, they have with the machine made an advance of three metres, and sometimes even four metres in the same time, and with only two men instead of six. The advantage, therefore, in the economy of the great standard expense of mining work is so obvious as to require no comment.

Another machine meriting attention for the same reasons is the "Bergborr maskin" of M. Bergström, exhibited by the mine of Persberg, in Sweden. The stand for it is a strong bar, with steeled point at the bottom, and steeled holders regulated by a screw at the top; and as the boring cylinder traverses up and down the bar, this latter must be fixed by the aid of cross timber, in a direction parallel to that of the intended borehole. The drill is then made to act by compressed air in a manner generally similar to the last, although there are considerable differences in the construction. The weight of the whole apparatus is only 120 lb., and it may thus easily be moved from place to place, although open to the objection of giving more trouble in the fixing. The very machine which is exhibited is stated to have worked for 700 days underground, and to have bored 1000 metres. When tried upon hard granite it has bored two metres in

* The daily wages made by French colliers in the central coal-fields are from 2s. to 4s., according to the nature of their work.

† The Anzin Company numbers at present, pensioned workmen, 256; pensioned widows, 455: in all—811; besides assisting 218 orphans.—*Burat, Les Houillères de la France*, 1867.

* See report of M. Cassagnes, Portefeuille Economique des Machines, December, 1864.

THE PARIS INTERNATIONAL EXHIBITION.

FIG. 1.

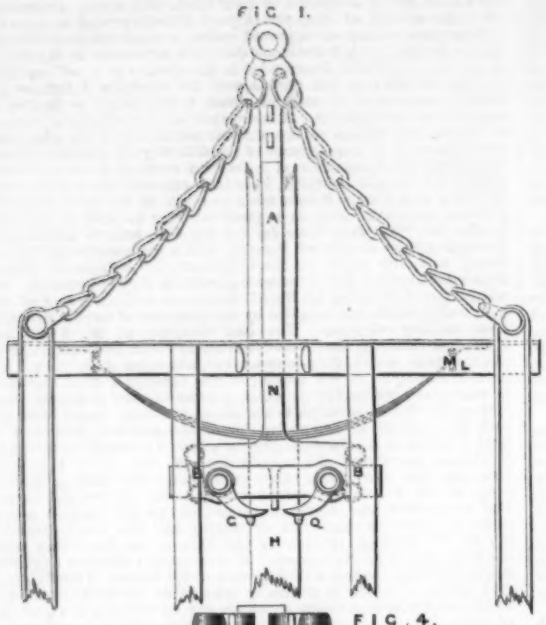


FIG. 2.

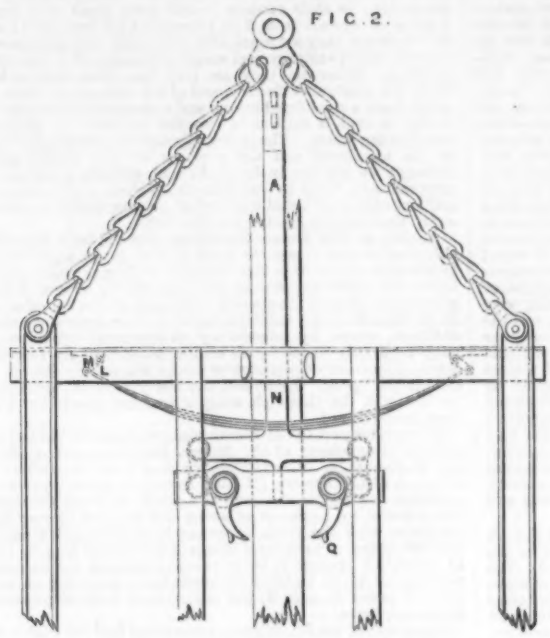


FIG. 3.

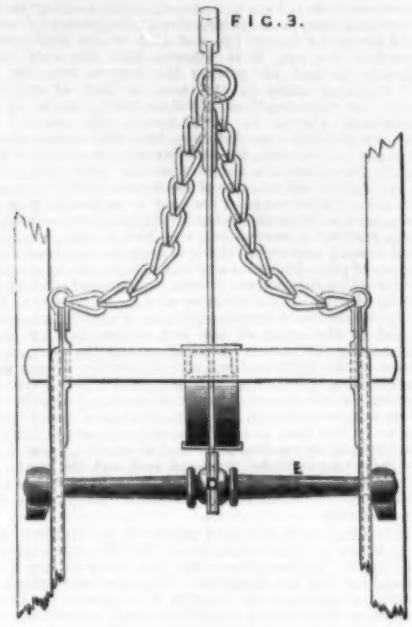


FIG. 4.

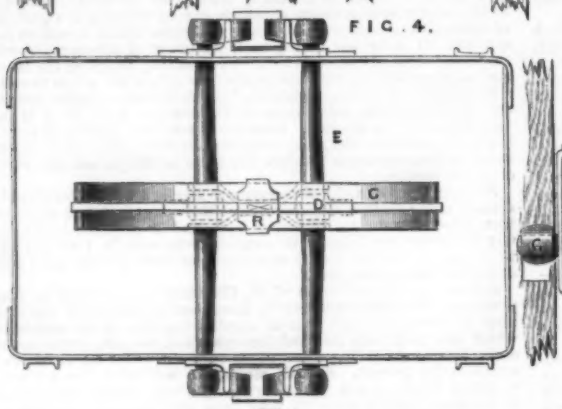


FIG. 5.

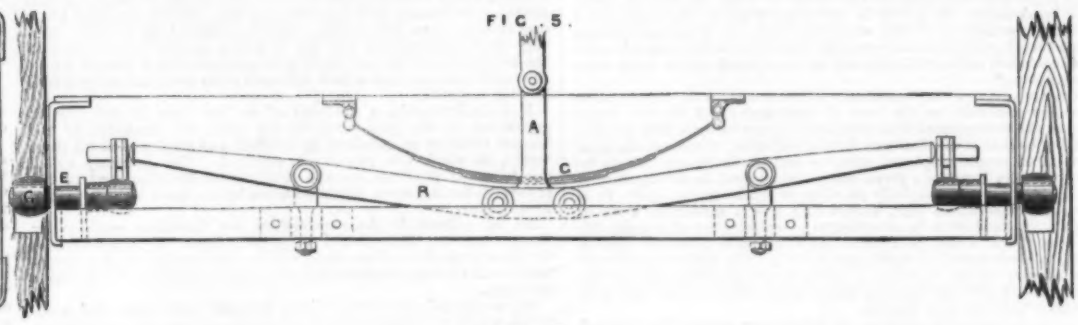


FIG. 6

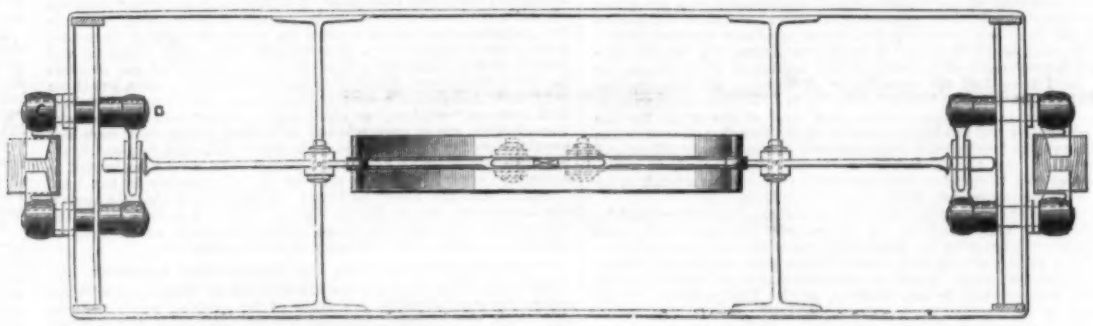
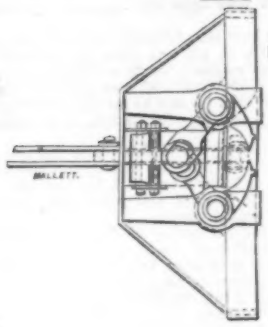


FIG. 7

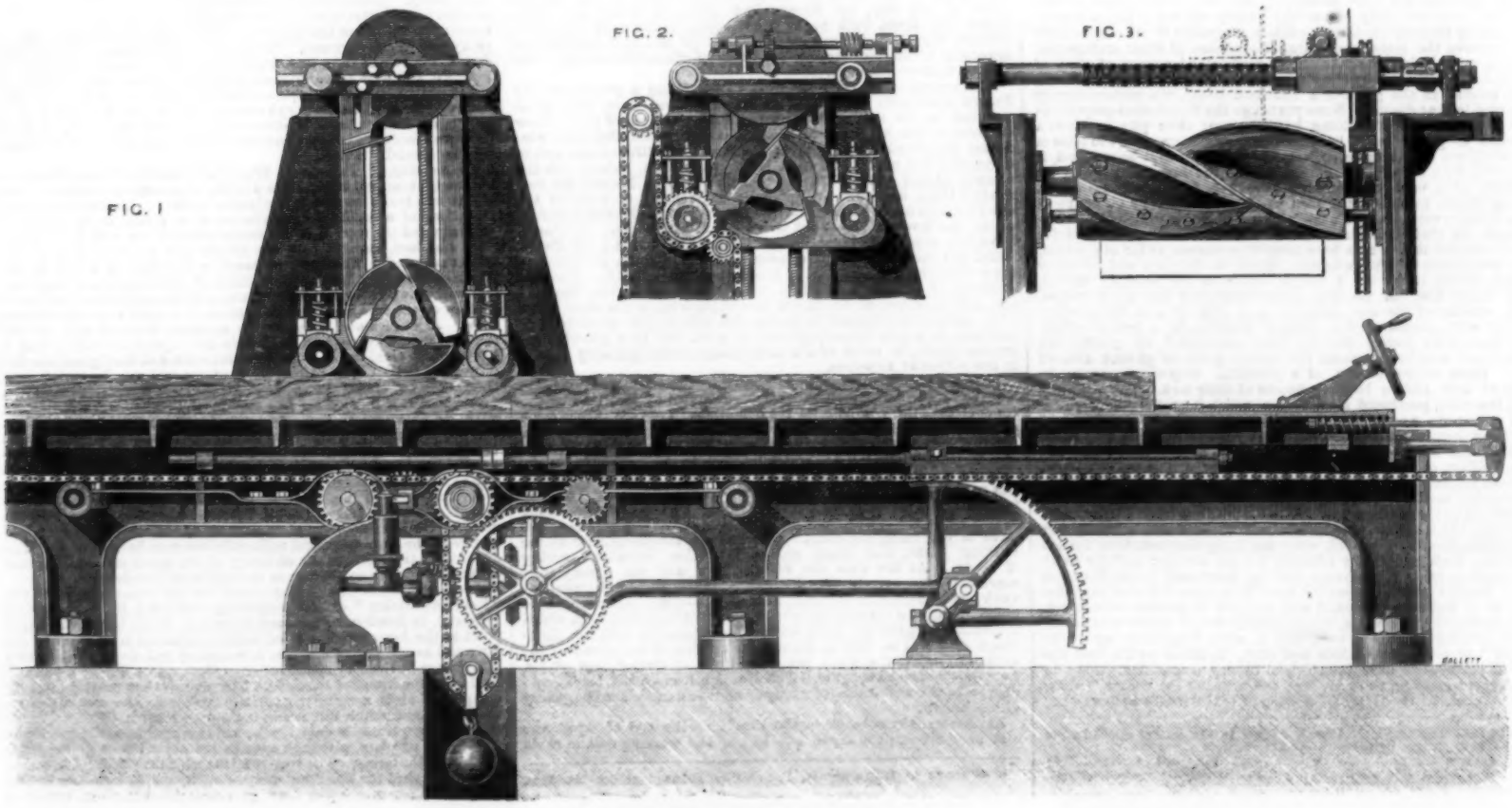


APPARATUS FOR DESCENDING MINES (CLASS 47).—SEE PAGE 384.

FIG. 1

FIG. 2.

FIG. 3.



PLANING-MACHINE (CLASS 50).—SEE PAGE 390.

THE PARIS INTERNATIONAL EXHIBITION.

the hour; and, as in Doering's machine, the "bit" has been found to last five times longer than when struck by hand.

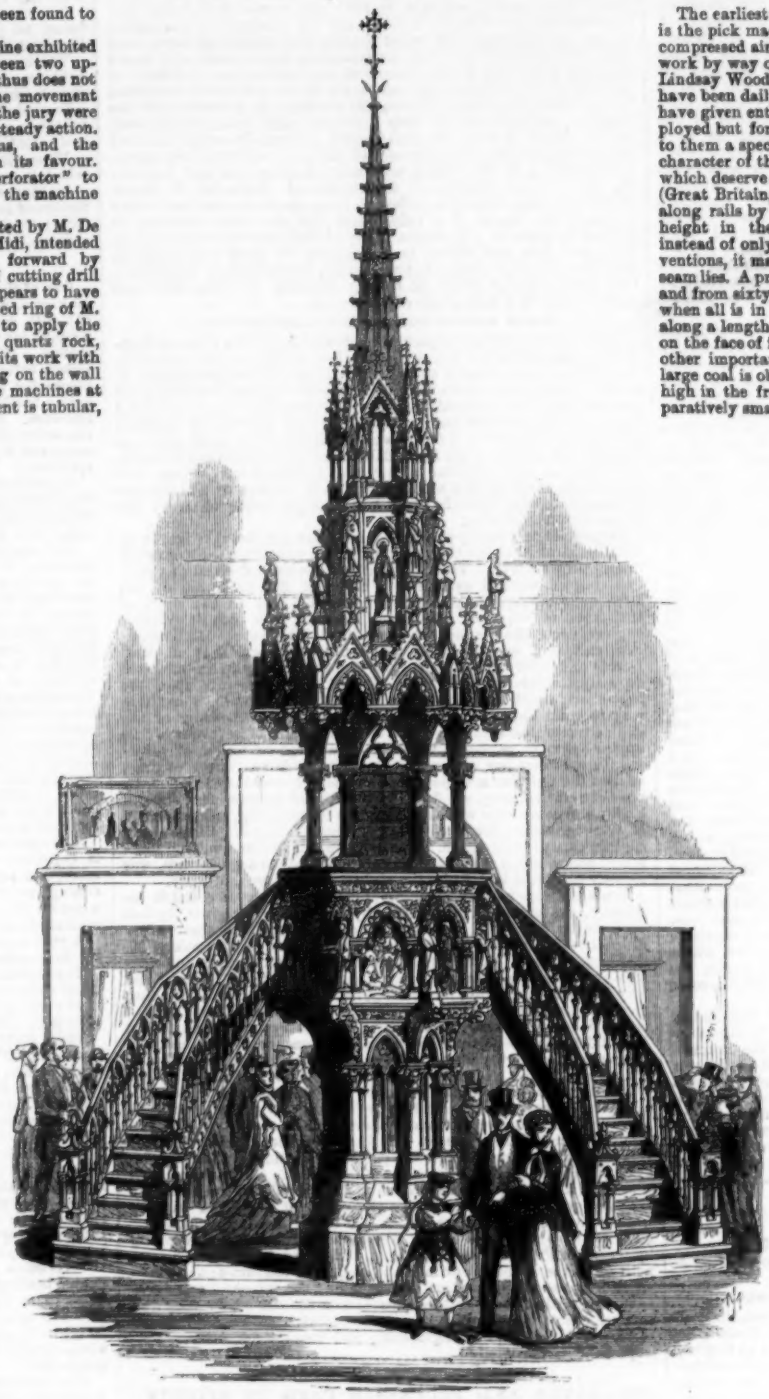
A third modification of this general type is the machine exhibited by General Haupt, an American. It is mounted between two upright bars, which are fixed between floor and roof, and thus does not admit of the same scope of direction as Doering's. The movement of the piston and drill is effected by steam; but whilst the jury were making their inspection it never could be brought into steady action. The valve arrangements are particularly ingenious, and the moderate size and weight of the apparatus are in its favour. A highly laudatory pamphlet accompanies this "perforator" to Europe, but does not contain any distinct statement of the machine having been actually employed in mining operations.

A very beautiful horizontal cylinder-engine is exhibited by M. De la Roche Tolay, engineer of the Chemin de Fer du Midi, intended to bore the rock by a rapidly rotating drill forced forward by hydraulic pressure of about 1540 lbs. Various forms of cutting drill have been experimented on, but the only one which appears to have given good results in hard rock is the diamond-mounted ring of M. Leschot. And, however preposterous it may sound to apply the valuable gem to the boring of holes in granite and quartz rock, visitors to the Exhibition may see it actually perform its work with considerable rapidity, and observe from a large drawing on the wall near it how it is proposed to arrange several of these machines at once for attacking a tunnel face. The boring implement is tubular, and admits a jet of water through the middle into the hole; its face, of soft iron, is studded with eight pieces of black diamond, carefully hammered up; and the incomparable hardness of the adamant encounters with such success the hardest materials of common rock that the engineer states the cost of the abrasion of diamond for a hole of half a metre deep to be under twopence. Very many experiments have been made at surface, but it is not asserted that the machine has been subjected to practical trial underground.

The tunnelling machine, by Captains Beaumont and Locock, R.E., impelled by compressed air and looking a "monstrum horrendum ingens," has already attracted much attention from visitors to the gallery of British machinery. It is a heavy powerful means of projecting against the face of the rock a disc armed at its circumference with thirty-six borers, which, gradually turning with the disc, cut an annular groove, whilst a central borer at the same time drills a hole of equal depth, which is afterwards to be charged with powder and fired. Whatever engineers may think of it for abbreviating the labour of tunnelling, it is too cumbrous, and, for various reasons, inapplicable for ordinary mining.

There is yet another machine to be mentioned which has done good service in economising labour and in preventing waste in the marble quarries of Rutland County, Vermont, U.S. It is the invention of Mr. Wardwell, and is exhibited in full size, in the outer shed of the United States department, by the Steam Stone-cutter Company, of New York. The machine, propelled by a small steam-engine of 4-horse power, consists of a carriage of 5 ft. in width, carrying on both sides a series of vertical bars armed with cutters which notch out a groove of the required depth instead of its being cut by the picks of the quarrymen. It is asserted that in these extensive quarries, where many hundreds of men used to be employed, the action of this machine, in reducing the labour cost and saving the marble by the narrowness and greater accuracy of the cut, has been eminently satisfactory.

COAL-CUTTING MACHINES.—Of far greater importance to this country are the attempts which for several years have been made to replace by machinery the labour of holing, kirving, or undercutting the seams of coal. The purely mechanical operation of cutting, by means of a light pick, a groove of from 2½ ft. to 4 ft. deep along the face of coal which is to be removed is not only slow and laborious, but wasteful, as cutting into slack a considerable amount of the seam; and, forming as it does the chief item of expense in the excavation of the coal, it has of late been more seriously forced upon the attention of coalowners by the irregularity and strikes of the workmen, which have so often brought the operations of the coal-mines to a ruinous standstill.



CARVED OAK PULPIT IN THE RUE DE BELGIQUE.

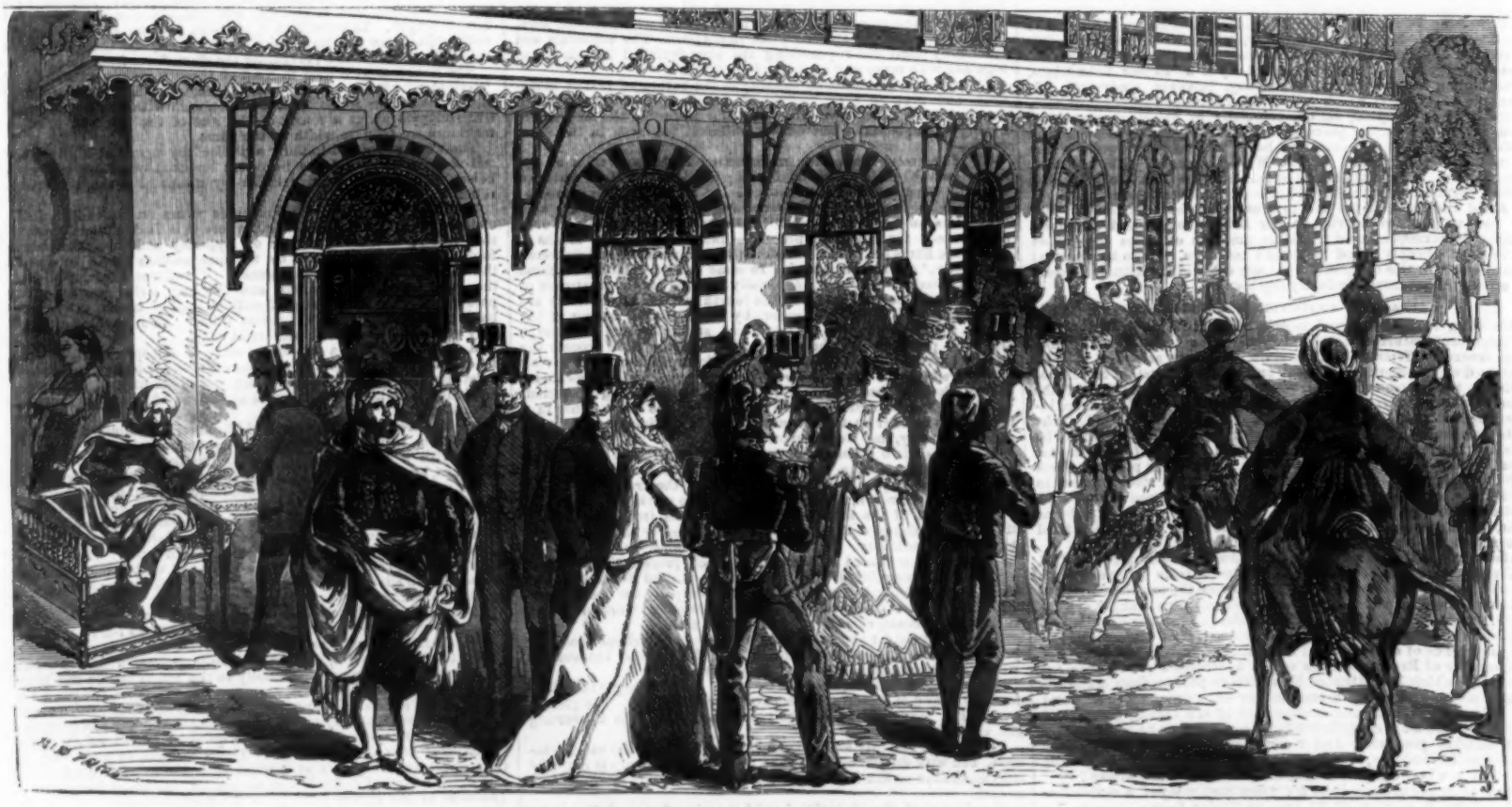
The earliest of these machines which may be pronounced a success is the pick machine of Messrs. Firth and Donisthorpe, worked by compressed air. I had the advantage of seeing it doing excellent work by way of trial in 1863, at Hetton; and I am informed by Mr. Lindsay Wood, now managing that great colliery, that two of them have been daily at work for upwards of four years, and that they have given entire satisfaction. More of them would have been employed but for the difficulties which arise in practice of adapting to them a special mode of work which shall also suit the particular character of the roof. Two newer machines are exhibited at Paris which deserve special notice. Messrs. Jones and Levick, of Blaina (Great Britain, 8) have constructed a very portable carriage, movable along rails by a hand-wheel, and mounting a pick at any required height in the seam, so carried in a revolving head-stock that, instead of only striking horizontally, as in most of the earlier inventions, it may be applied to any angle of inclination in which the seam lies. A pressure of 30 lb. to 37 lb. is applied, through flexible tubes, and from sixty to seventy blows per minute are given, with a result, when all is in order, of undercutting to the depth of 3 ft. or 3½ ft. along a length of 9 yards to 15 yards in an hour. This would appear, on the face of it, to be a substitution for a great number of men; but other important advantages are gained. A better proportion of large coal is obtained; and, the holeing groove being very much less high in the front than where the hand-pick is employed, a comparatively small quantity of coal is cut into slack.

These advantages are also shared by the machine of Messrs. Carrett, Marshall, and Co., of Leeds (Great Britain, 8), a more complicated apparatus, the chief feature of which is a strong steel bar, armed with three cutters or scoops, and forced by hydraulic pressure against the coal in such wise as to form the undercut by a sort of planing action oblique to the face. Instead of passing three times along the front of the coal, as do the pick-machines, in order to cut inward to the required depth, this contrivance completes the full depth at once, and without percussive action, or making dust and noise; it moreover cuts through iron pyrites and band-stone with facility. Mr. J. Liddell, of Newcastle, has kindly informed me that he has had one at work occasionally, and experimentally, for twelve months; that, when in full order, it has cut as much as twelve yards in an hour; but that, from circumstances in the seam of coal, the mode of working, &c., he is not yet in a position to give definite results as to the economy of its use.

It is unnecessary to dwell at length on the various ingenious arrangements which have been applied to these machines, but we may point with satisfaction to the inventions of our countrymen which are likely to aid in maintaining our position as the first producers of cheap coal; and the importance of the subject is further shown by the liberal offer of the colliery proprietors of South Lancashire and Cheshire to give prizes of £500, £200, and £100, for the first, second, and third best coal-cutting machines which shall have been fairly tested by their committee, in trials to commence in November next.

COAL-PIT FITTINGS.

Whilst our British producers of mineral deemed it not worth their while, for the sake of a medal and a small modicum of glory, to incur the trouble and expense of sending over to Paris the familiar forms of apparatus which they employ, a number of French and Belgian coalowners have forwarded models and full-sized fittings, which, if they have nothing specially new about them, yet play an important part in showing the present position of the mechanical arrangements brought to bear on their mines. Thus, the Company of Béthune (Pas de Calais) exhibits, in its full size, a stout pit-head frame, with flat-rope pulleys, wooden guides, cages, and tipping arrangements, all of them very similar to examples which we may find at home. The colliery is an interesting one, as being founded on that portion of the northern coal-field which has been so skilfully explored beneath its complete covering of the chalk formation, and being advanced to within a moderate distance of the Channel. Here, as in most of the recent establishments, the apparatus is on a good scale, and calculated to serve the purpose of working an extensive area from one set of pits. The Blanzy Company (Saône et Loire) represent



ROW OF SHOPS BENEATH THE PALACE OF THE BEY OF TUNIS.

in model another form of wooden frame, housed in, with a neat belfry-like roofing even over the sheaves or pulleys. A more novel construction is represented among the excellent collection of the collieries of the Loire (St. Etienne, &c.), placed in a special building in the park. The leg, beams, stays, and shedding are all of wrought iron, as erected at the pit of St. Louis in 1864. A different system, that of building the main beams as cylinders of sheet iron, riveted together, had in 1862 been adopted at the pit Jabin, and after four years of work stands perfectly well. The magnificent pit-head frames of the Forster pit, at Seaton Delaval, are known among us as a good example of wrought iron applied to this purpose, but the economy of the use of the metal as compared with wood is not yet fully proved. The French fittings in wrought iron have been tried, on the observation of the engineers that, in their districts, six years are sufficient to render unserviceable the common head-stocks of pine; whilst ten years bring even oak to such a condition as to require expensive repairs. Pit ropes are exhibited of various forms and material. The heavy flat ropes of aloe-fibre are much employed in the north of France and in Belgium, where some of the shafts are of greater depth than any in our own country.

In the better collieries of both the above countries cages of a construction similar to those of our northern pits are very generally employed for the conveyance of the tubs or waggons up and down the shaft. Many of these are exhibited in full size, some of them two-decked, to carry two tubs or waggons on one floor; others, for narrow shafts, having four tiers or decks for one tub each.

M. Libotte (Belgium, 16) shows cages for six tubs—one with two tiers of three tubs each; the other, of very awkward length, of six decks. The former weighed, when constructed, as usual, of rolled iron, 3960 lb.; the latter, 4180 lb. Simultaneously with what is doing in some of our Durham and Northumbrian mines, this engineer has been substituting steel for iron, in order to reduce the dead weight, and thus brings his new steel cages for the carriage of the same amount of coal to the more moderate weights of 2200 lb. and 2640 lb. respectively.

Ever since the Great Exhibition of 1851 numerous inventors have turned their attention to the subject of providing the cages with safety-catches, intended to grip the guides in case of the breakage of the rope. In 1855 and 1862 a long list of contrivances had to be reported upon; but, even up to the present day, the opinions of those most conversant with pit machinery are divided on the question of which of them, if any, is preferable to simply doing without them, if only due caution be exercised in employing the very best material and frequently overhauling the rope. It is matter for regret that none of our English inventors appear this time in the field, since Calow, Owen, White and Grant, Aytoun, and others, have devised various ingenious modes of attaining this important object, and many of our English pits have been thus fitted for years past. There was nothing new to see on the present occasion. One of the oldest, and theoretically perhaps a rather objectionable form, that of Fontaine, is still shown as in use at the great Anzin collieries, and merits respect from the number of lives it has actually saved. Jacquet, of Arras, and others exhibit a clutch acting by a toothed excentric, similarly to that of White and Grant; and M. Nyst, of Belgium, his system of applying a pair of iron forks to trapezoidal wooden guides. M. Krauss, of Prussia, also exhibits what appears to be a good modification. Where the speed of winding is moderate, as in many of the Continental and of our central and southern collieries, several of these varieties may do good service; but where the great velocity of Lancashire and the north is in vogue, the tendency of the clutches to come into play during the rapid descent is very troublesome and even dangerous.

Among safety-lamps for fiery collieries several of the known modifications of the Davy are exhibited, and among them sundry contrivances for more effectually locking them than by the common method. A new one is that of M. Arnould, of Mons, who so inserts an iron pin that the lamp can only be unlocked by placing it in a proper position over the poles of a powerful magnet, and thus puts it out of the power of the men to expose the flame. Unfortunately, however, as we have too sadly seen in some of our late colliery accidents, all these precautions may be rendered utterly futile by the determination of colliers to carry lucifer matches in their pockets for the ready getting a light, when, against all rules and all prudence, they choose to strike it.

For the ventilation of mines nothing new has been proposed since 1862. But there are placed along with the fittings of the French collieries models of fine examples of the ventilators of Fabry, of Lemielle, and Guibal, the last two of which are now introduced with success into some of our English coal districts.

DRESSING, OR MECHANICAL PREPARATION OF ORES.

A variety of apparatus in this department is exhibited, little of which is characterised by novelty. The company of Fives-Lille (France, 55 and 87), whose engineers are Messrs. Huet and Geyler, make a considerable display in the gallery of machinery, of circular revolving tables, jigging-hutches, &c., of iron, not without merit, and of some novelty to France, but following very closely the models of a well-known Prussian manufacturing house at Deutz, near Cologne.

The Austrian mining administrations of Przibram and Schemnitz have sent drawings and models of a number of useful inventions for the dressing of silver-lead and of gold ores. Most of them are the production of Mr. P. von Rittinger, whose able services in this direction have gained him a European reputation; and they have been already shown and commented upon at former Exhibitions. Our mining agents and engineers may, however, study with advantage the models which tell of his efforts to obtain continuous, instead of interrupted, action, especially in his jigging-machine, and in the side-action percussion frame or shaking-table. Of the latter contrivance two examples have been recently erected at the mines of the Vigra and Clogan Mining Company, North Wales, where they act admirably in separating the metallic sulphides, which occur along with the gold in their St. David's lode.

Amid the sad collapse and pressure which have for the last year or two weighed so heavily on our British copper and tin mines, simply in consequence of the large amounts of these ores which have been cheaply raised in distant countries, it is to be regretted that neither in this department nor any other of the actual processes of mining is our insular industry represented.

APPARATUS EMPLOYED IN METALLURGY.

Omitting to notice several models of blast-furnaces, which offer no important feature of novelty, I should remark that the exhibitors from several different countries show that more attention is being bestowed on the economy of heat and on the utilisation of inferior fuels, by the introduction of gas-furnaces and of apparatus of the class of the regenerator of Messrs. Siemens. Some of the more interesting of these were contributed by Sweden, especially the elaborate model of M. Lundin, showing the method by which he obtains the inflammable gases from wet sawdust (which in vast quantity has hitherto in that country been a waste product), frees it from watery vapour, and then applies it to a steel-furnace, to brick-kilns, or other purposes. Lundin's arrangement would be applicable to the burning of such materials as wet peat, inferior coals, and lignites, which are of very little or no value when tried on common fire-bars.

Among the extensive collections exhibited by Schneider and Co., of Creusot, in a special building in the park, some large drawings are well worthy of observation which illustrate the excellent arrangement of the enormous mills and forges and machine-making departments of that establishment. Some of the jury of our class indeed concluded (and it was the only subject on which we had a considerable divergence of opinion) that the distinguished Vice-President of the Chamber of Representatives ought to receive a *grand prix* for the success which had attended his efforts to produce from materials of only moderate quality manufactures of great excellence; and they held that the judicious arrangement of the various groups and divisions of the work contributed in no small degree to the economy of his finished products. And it certainly was no light argument to point to the building, out in that remote south-eastern portion of France, of a whole army of locomotives for a British railway!

The French ironmasters have for years past enjoyed a reputation for the rolling of good qualities and particular forms of iron. In 1855 the capital iron girders which were being abundantly employed in the erection of common street houses aroused the interest of many of our jurors; and now, in 1867, the works of Châtillon and Commentry, and of Petin, Gaudet, and Co. distinguish themselves by the finest examples of rolled girders and plates that have been seen. To understand, in fact, how some of these beams of 1 metre high and with very broad flanges at top and bottom had been so well and evenly rolled, it was necessary to see the model exhibited by the former company (France, 88), showing on a small scale the complex arrangements of their universal mill, *laminoir universel*. Messrs. Marel Frères, the well-known makers of many kinds of machinery, exhibit a rolling-mill of the same elaborate character. It is placed near the boring apparatus of Dégousée and Laurent. M. Wagner, the director of the works of Mariazell, in Styria (Austria, 5), also furnishes, although on a much smaller scale than the last, the model of a rolling-mill for the same purpose, as devised by himself. No doubt many of the products turned out by these machines, and shown in the Champ de Mars, may fairly be considered *tours de force*; but we cannot withhold from the French iron producers the credit of having attained by their skill and perseverance to a high grade of excellence.

STEAM-ENGINES FOR WINDING AND PUMPING.

If there were any one department of machinery in which we Englishmen used to think, a few years ago, that we had it all our own way, it was the construction of steam-engines. And although it might be conceded that taste was to be found across the Channel, and that good designs might be produced, and, perhaps, even light work executed by French and Belgian engineers, still it was confidently asserted that, for heavy work and for powerful engines, they must come to England. A glance at the Paris Exhibition will dispel these illusions, and teach us that machine makers and designers have arisen who have made good use of a sound education in mechanics, and who are competent to cope with the tasks daily brought before them by the progress of engineering.

Several large winding-engines for collieries are brought before us in full size, and exhibit the types which are now attached to some of the first-class works. Thus, M. Quillacq has erected an engine with two coupled vertical cylinders in front of the pit-frame of the Bethune Company, the piston-rods acting directly on the shaft of the drum or rope-roll. Belgium has sent two double-cylinder engines, each, like the last, of about 200-horse power. Both these, that exhibited by the Chatelineaux Company, and that of MM. Dorzée and Andry (Belgium, 19 and 6), have their cylinders mounted on a pyramidal iron framing, and working downwards upon the rope-drum, which is placed at the level of the ground. Something may be gained by this mode of construction in the economy of the engine-house, but several reasons might be adduced in favour of the opposite system, generally followed at our large collieries, of planting the cylinders low and mounting the drum above. These engines, as also the well-finished, powerful, horizontal machine exhibited by the Creusot Company, are fitted with a special cylinder for a steam brake, and sometimes with an apparatus for arresting, independently of the engineman, the progress of the cage on its going dangerously high in case of inattention. One of these contrivances, a long horizontal screw, along which a carriage travels as the cage ascends, was already exhibited in 1862 by the maker, M. Gouteaux, of Gilly.

Some modifications of pumping-engines, which evince much ingenuity, are exhibited in drawing by M. Colson (Belgium, 5), but their merits can scarcely be pronounced upon without observation of their effectiveness in practice. The French engine-maker, M. Quillacq, of Anzin (Nord), not only exhibits his productions in drawings and actual engines, but excited the incredulity of some of the jury by a statement that he had supplied both pumping and winding steam engines to an important Newcastle colliery. That such a Gallic invasion of our great centre of colliery operations should have taken place without some special reasons or private arrangement appeared highly improbable, and I at once communicated with the owner for the purpose of obtaining the explanation. It is but justice to the French engineer to state that the order for the direct-action pumping-engine which he supplied was given simply in consequence of his lower price and better finish as compared with the tenders from English houses. It has now been at work above eighteen months, and I quote the particulars kindly sent me by the owner in saying that "it has given the greatest satisfaction," and that "the construction and the quality of material and workmanship are very good." This has led to the order of a pair of winding engines for the same place, which are also "highly satisfactory." Here we have, then, one of our Newcastle mines actually working by means of French-made machinery, fairly brought in by open competition to the midst of our machine shops and foundries; and when we look at the inland position of Anzin, and the unquestionable disadvantages which have to be combated in a district where coal and iron are comparatively dear, I cannot but think these results redound to the credit of French engineering and inculcate on ourselves an important lesson.

APPARATUS AND PROCESSES USED IN SPINNING AND ROPEMAKING.—Class 55.

BY PETER LE NEVE FOSTER, JUN., C.E.

In this class is comprised all machinery and apparatus used in the preparation and spinning of textile materials, of which cotton, wool, flax, hemp, and silk are the most important. The materials and machinery used for ropemaking are also included in this class, together with ropes and cordage of all kinds.

From the great difference existing in the nature of textile materials, and even in their individual qualities, different modes of treatment are necessary. In cotton, for instance, the length and quality of staple varies not only in different but even in the same species.

The first process in cotton manufacture is the separation of the seed from the staple by means of gins; the next is to clean and open the bales of cotton, which arrive at the mills in a highly-compressed state. This is effected by means of scutchers and beaters, with ventilators, to free it from dust. The cotton is delivered in an even fleece, ready for the third process—that of carding—by means of which the fibres are drawn out straight and parallel, and delivered in "slivers," or bands of cotton. In some cases a combing-machine is substituted for this, and is especially adapted for the treatment of the fibres of fine numbers. In the fourth process these slivers are drawn out and doubled, in order, by the repeated mixing of the staple, to equalise their consistence and substance, and to arrange the fibres perfectly straight and parallel. In the fifth process the slivers are delivered to the slubbing, intermediate, and roving frames; where the yarn receives the first twist, and is repeatedly drawn, doubled, and twisted, ready for the spinning operation, which finishes the extension and twisting of the yarn either in a continuous manner on the throstle or in a discontinuous manner on the mule finally, and wound upon bobbins.

Wool is of two different kinds—the long and the short staples, each of which requires a different manner of treatment in the preparation and spinning processes, as also in the treatment of the cloth after it is woven, in order to fit it for the market.

The length of the fibres of long wool varies from 3 in. to 8 in.; this is not carded as cotton, but combed, like flax or hemp, either by hand or by machinery. Short wool is seldom more than 3 in. or 4 in. in length, and is carded and felted, by which process the filaments become first convoluted and then closely matted together. The shorter sorts of combed wool are used principally for hosiery, and the longer are manufactured into hard yarns for worsted pieces, such as waistcoats, carpets, poplins, crapes, &c.

The wool used for the manufacture of good cloth should not only be shorter but generally speaking softer and finer than the worsted wools, in order to suit it for the fulling process.

Flax machinery is required to be made much stronger than that for cotton, and it requires more power for driving it. The greater cost of flax yarns arises from the practical difficulties in converting and working the raw material.

Flax, hemp, and jute are all spun by machinery on the same principle, but with difference in size and proportions. Hemp is not only inferior in fibre to flax in softness and substance, but is more difficult to spin.

The leaves of the aloe also furnish an abundance of fibre from which ropes are made. Some excellent specimens of cordage made from this fibre are exhibited.

The machinery for the treatment of silk is extremely simple, there being no preparatory machinery required as for cotton. Silk is imported in skeins wound direct from the cocoons.

The first process is the winding of the skeins as imported off on to bobbins, and removing the irregularities and knots by passing the fibre between the edges of the cleaner, formed of two bars of steel, adjustable by screws, to pass the maximum thickness allowed, and to intercept fibres of extra thickness. It is then doubled, twisted, and reeled. These processes are called "throwing silk."

Floss silk, or "bourres de soie," consists of the shorter broken silk, which is carded and spun like cotton.

In France the principal part of the machinery used for the manufacture of cotton is made at Rouen; flax and hemp machinery, at Lille; Alsace furnishes cotton machinery, and machinery for carding and combing wool and floss silk.

FRANCE.

One of the most important exhibitions of cotton machinery is that of Messrs. Schlumberger and Co., of Guebwiller (Haut Rhin) (19 and 51). It consists of a "breaker" carding-engine with automatic stripper for "top flats," on which there are eighteen, on "Wellman's" system. The cotton is opened and cleaned by a pair of working rollers before reaching the flats. The flats are lifted out of their places for the purpose of stripping without being turned over, and a wire brush is drawn across the face of the flat to remove the fly and dust. The flat is pressed gently down upon the brush during the action of stripping. The mechanism for stripping is effected by cams, and is particularly ingenious and simple, and imitates stripping by hand.

A double carding-engine, consisting of a first, or breaker, cylinder, fitted with four pairs of working rollers, and the "finisher" cylinder, with ten self-stripping flats, on Wellman's plan, is shown by this firm. The doffing-comb is fitted on a hollow steel axle.

The combing-machine exhibited by Messrs. Schlumberger is the invention of M. Heilmann, of Mulhouse, and is especially adapted for combing cotton of fine numbers. The lap is placed on two revolving wood rollers at the top of the machine, by which it is caused to unwind and deliver a sheet of cotton down an inclined guide between fluted steel rollers, which place the cotton between the open jaws of a pair of iron nippers; the nippers then close, and by suitable cam motions are made to approach the revolving comb-cylinder, where the cotton is held by them till all the short fibres and impurities are cleaned out. The combs are cleared of fly and dirt at every revolution by a cylindrical brush. As soon as the combs have passed through the cotton, the nipper recedes from the cylinder and opens, to allow the partly-combed fibres to be partially drawn out of the lap by means of a leather-covered roller, working for this purpose in contact with the fluted segment on the comb-cylinder, and with fluted detaching rollers. The drawing out of these fibres causes the ends, which were previously held in the nippers, to pass between the teeth of a fine comb, and thus prevents any waste being drawn forward.

The machine is arranged in such a manner that the tuft of cotton is deposited on the detaching roller so as the ends overlap each other, and are united in a continuous sliver, to be deposited in a coiling-can on one side of the machine, whilst the waste is coiled in a can on the other side. This machine is made with six deliveries, each of which produces 13¼ lb. per day.

A combing-machine for wool, on the same principle, is exhibited by these makers.

The slubbing and roving frames exhibited by this firm are of the usual construction.

The self-acting mule of Messrs. Schlumberger is most ingeniously arranged, and adapted for spinning fine numbers.

These makers also exhibit a set of two carding-machines for wool, consisting of "scribbler" and "condenser"; these are of the usual construction, with ordinary feed lattice, &c.

The best display of wool machinery is that of M. Mercier, of Louviers (Eure) (37); it consists of both carding and combing machinery for short and long wools. Carded wools undergo the following processes:—

The burring-machine, 48 in. in width, is provided with Bolette's self-acting feeder, consisting of a hopper, into which the wool is thrown; at the bottom of this hopper is a travelling lattice, for the purpose of bringing the wool forward within range of the hook-shaped teeth of a vertical lattice, by means of which the wool is lifted in a regular manner and feed into the beaters, the first of which is a cylinder with four longitudinal blades; it then passes to the second, a cylinder armed with four rows of strong teeth. This double beating has the effect of opening the wool and facilitating its being taken by the teeth of fifty-four comb-blades fixed on a hollow cast-iron cylinder 22 in. in diameter; between each comb-blade a long slit is made about 3-8ths of an inch in width, extending the whole length of the cylinder; this is for the purpose of keeping the combs free.

The openings of the grating under the first beater can be regulated so as to facilitate the exit of the burrs.

The production of this machine is from 88 lb. to 110 lb. per day.

In the next process, of teazing, the wool is put into the self-acting feeder of a machine consisting of an iron cylinder covered with twenty-four iron bars, each armed with a double row of strong teeth 2 in. in length. This machine is provided with an arrangement for oiling the fleece previous to its being carded, for the purpose of softening the wool and preventing the short fibres from flying.

The wool is next carded in a set of three machines consisting of "scribbler," "intermediate," and "condenser." The main cylinders of these machines are 44 in. in diameter, each with five workers and five strippers about a fourth of the size of the workers. These machines are 44 in. in width on the wires.

The wool is supplied to the "scribbler" by means of M. Bolette's self-acting feeder; and the burrs are knocked out from the wool before reaching the main cylinder by means of a small burring-roller armed with saw-blades.

The sliver delivered by this machine passes on an endless feed-cloth to the "intermediate" card, where it is laid obliquely across the feeding-lattice by means of Apperley and Clissold's patent feeder. The sliver delivered by the intermediate serves to supply the condenser in the same manner. The fleece is stripped from the condenser by two doffers, and the fifty strips are felted by passing between two pairs of endless leather bands or rubbers having an alternate motion across them. This machine delivers fifty good threads and two wasters at ends.

M. Mercier exhibits a self-acting mule of 400 spindles fitted with a "double speed," which is very serviceable; it being desirable to twist the thread whilst being drawn just sufficiently to prevent its breaking, and when the carriage is at the end of its stretch to give it an extra twist.

For the treatment of long wool M. Mercier exhibits a carding-engine 44 in. in width, consisting of two main cylinders, and provided with a self-feeding apparatus, similar to that previously described, breast rollers, and burring-cylinder armed with saw-blades.

The wool, after the burrs have been knocked out by the burring-cylinder, is transferred to the breast-roller furnished with three working rollers and clearers, where it is prepared for the first main cylinder; this is followed by another roller of the same diameter as breast roller to prepare it for the second main roller. The fleece is removed in the usual manner by the doffer and a vibrating comb and formed into a sliver which is wound into a ball for supplying the combing machine.

The combing-machine, which is of most novel construction, is the invention of Mr. Noble, and produces from 200 lb. to 700 lb. per day.

This machine consists principally of a circular horizontal comb, about 5 ft. in diameter, formed of needle points, with two small circular combs revolving tangentially to the larger one on the same diameter. The balls of slivers, seventy-two in number, are placed in a framework underneath, and, revolving with the comb, the ends of the slivers pass separately through holes and through guide troughs; the slivers are kept from unrolling too quick by a small weight under which they pass in the troughs. These troughs, in revolving as they approach the points of contact with the smaller combs, are raised, by means of a fixed cam or incline, up which they travel. The ends of the slivers passing to the comb are pulled out by the slight resistance offered by a bar under which they pass; the ends

thus pulled out project over the inner and outer combs at their two points of contact, and the tufts of wool are placed on the teeth of the combs by a descending brush at each end of the crank-shaft, making about 300 revolutions per minute whilst the large comb makes from 3½ to 4 revolutions. As the combs revolve, the ends of the tufts of wool placed on the teeth are guided by endless bands of leather between four pairs of fluted rollers, which are placed in convenient situations for the purpose of forming two slivers from the large comb and one from each of the smaller ones. These four slivers are then passed to the top of the machine, where they are formed into one by passing through a series of rollers and wound into a ball. The short refuse wool remaining between the teeth of the combs are removed by triangular plates or cleaners, and lead away to cans placed at the bottom part of the machine.

The fibres of the wool are drawn out and laid parallel, either after combing or carding, by means of a "screw gill." The gill head is supplied with a certain number of balls of sliver, which are placed in a crul or framework for that purpose. This machine is composed of an endless succession of bars called "fallers," bearing combs of closely-ranged steel points, through which the slivers are drawn. These bars are guided forwards by means of two screws with an eccentric at the ends for the purpose of lowering the gill bar on to another pair of screws revolving in the opposite direction, by which they are brought back to their former position, into which they are lifted by other eccentrics. These slivers are held back by a holding-back roller, so as to allow the teeth of the gills to act upon the wool.

A self-acting mule of 450 spindles and four rows of drawing-rollers is exhibited by these makers.

M. Vouillon, of Louviers (Eure) (38), shows a machine, constructed by M. Mercier, for the production of "fils feutres," threads which are not spun, but felted. The thirty slivers from the condenser are passed, on an endless felt band, covered with linen, under four wooden rollers, covered in a like manner. These rollers have an alternate motion across the endless band, and in this manner the slivers are rubbed into yarn. A steam-pipe is introduced between the first two rollers, for the purpose of heating the wool in order to facilitate the operation of straightening the fibres.

Messrs. Stehelin and Co. of Bitschwiller (Haut Rhin) (61), exhibit both woollen and cotton machinery.

For cotton, they exhibit a set of two carding-machines with the intermediate process of lap doubling. The "breaker" carding-machine is of the usual construction, with workers and cleaners, and the "finisher" is furnished with eighteen self-stripping flats on Wellman's system. Besides these, this firm exhibit drawing, slubbing, and roving frames, and self-acting mule, of good design and construction. The self-acting mule is of 442 spindles, with four pairs of drawing-rollers, the end pair of which are weighted. The chief novelty in this mule is the form of the carriage, the back of which, in plan, forms a parabolic curve, instead of the back and front being parallel, as those generally in use.

For wool they exhibit two carding-machines and a circular wool-combing machine of ingenious design. The wool, in ten or more slivers, are led forward by a screw gill, on which it is placed by a descending brush; the tuft of wool is then seized by a pair of jaws, that take it forward; a comb next takes it from the jaws and deposits it on the revolving circular comb; the ends of the fibres which project outside the teeth of the comb are guided, by an endless leather band, to a pair of fluted rollers, by means of which they are drawn away from the teeth of the comb and formed into a sliver by passing through the centre of a hollow revolving cone, and deposited in a can at the side of the machine. The waste wool remaining between the teeth of the comb is cleaned out by means of triangular plates, and drawn away by a pair of fluted rollers and deposited in another can.

The production of this machine is from 220 lb. to 660 lb. per day, according to the quality of the wool that is combed.

Messrs. Morel and Co. (82), of Roubaix, Nord, also exhibit a circular wool-combing machine. The slivers, supplied from fifteen bobbins fixed in a creel, are brought forward over the circular, horizontal revolving comb, where the tuft of wool is seized by a pair of jaws and placed upon the teeth of the comb by a descending brush; the fibres projecting from the comb are guided by an endless leather band, and are drawn away by a pair of fluted rollers and formed into a sliver, which is deposited in a can. In this machine there are two feeds, the one opposite the other; and two slivers of combed wool are formed, one on each side. The short waste wool is cleaned from between the teeth of the comb by means of triangular plates, and led away by a pair of fluted rollers to a can. The circular comb is formed of eight concentric rows of steel teeth fixed on a revolving cylinder; the cam motions by which the jaws and brush receive their respective movements are formed by a projection cast on the inside of the cylinder.

Messrs. Pierrard-Parpaite and Sons (93), of Reims (Marne), show important and well-constructed machinery for cleaning and spinning wool consisting of opener, scouring and wringing machine, carding-engine, and continuous spinning-frame.

The opener consists principally of a cylinder provided with a quantity of conical teeth fixed, slightly inclined in the direction of the revolution. The wool is fed in on an endless lattice, the fibres are drawn out and opened, and the inclined teeth tend to send the wool forward and deliver the wool on the opposite side of the machine.

The scouring-machine consists of several vats, into which the wool is steeped, containing hot alkaline lye, where it is worked about by forks moved by cranks; it is then taken out, rinsed, and dried. These vats are placed at different levels, so that the liquid in the top one, which receives the clean water, can be emptied easily into the next, and so on in succession. The wool is dried by being passed between rollers covered with woollen felt, which undergo considerable pressure, and effectually squeeze out all the water.

The carding-machine exhibited by this firm is of usual construction, with double doffing rollers and leather rubbers for felting the threads.

The principal feature in the spinning-frame is that the spindle and flyer work quite independently of the other, and are driven by independent gearing, the flyer with a constant, and the spindle with a variable, speed. Each spindle and flyer can be stopped in a very simple manner, without its being necessary to stop the whole machine. The bobbins filled with yarn from the roving-frame occupy the top part of the machine, and passes through the usual pairs of drawing-rollers to the spindles through the hollow part of the flyer, which is provided with arms of equal length with a spiral groove cut in one of them, down which the thread is led, and in this manner is protected from the effects of the centrifugal force occasioned by the high speed of the spindles.

A continuous spinning-machine is exhibited by M. Ryo-Catteau (35), of Roubaix (Nord), the rail of which is lifted by a cam motion arranged in an ingenious manner.

A flax-hackling machine, with vertical sheets, is exhibited by Mdme. Ward (159), of Lille (Nord). The flax, suspended in its holder, is passed progressively from one side of the machine to the other on a slide placed above the hackle-sheets, and is thus hackled at the same time on each side in its course through the progressively finer hackles. The hackle-sheets are kept clean by means of brush-rollers at the bottom part of the machine, and then are cleaned by means of rollers covered with card-clothing, from which waste is doffed by means of a vibrating comb. The vertical sheets run together parallel, and are so geared that the hackles of one intersect the interstices of the other.

The only ropemaking machinery in the Exhibition is that shown by M. Ouarnier-Mathieu (54), of Compiègne (Oise). These machines occupy but little space, and ropes of great length can be made without the necessity of long ropewalks.

M. Vimont (60), of Vire (Calvados), shows a throstle, or continuous spinning-frame, of novel construction. The wool, after passing through the drawing-rollers, is twisted by passing through a small eye, making about 3000 revolutions to the tension. The tension is produced by the thread passing over two triangular flyers. The winding on is effected by the ring and traveller, and the coping motion by a rack and pinion for lifting the rail.

A most effective machine is exhibited by M. Buzon, of Paris, for preparing shoddy of woollen rags, for recarding and tearing up other rags for papermaking, &c. The rags are fed in by means of an endless feed-cloth between a pair of iron rollers, the bottom one of which is covered with indiarubber, within range of a drum making about 1000 revolutions per minute, covered with steel teeth resembling those of a circular saw; the top roller is kept clear by means of a knife which prevents the wool being wrapped round it. The drum is cleared of wool on the delivery side by a circular brush. This machine requires about 1½-horse power, and produces from 300 lb. to 400 lb. per day.

A circular wool-combing machine is exhibited by Messrs. Prouvost and Co. (43), of Roubaix, Nord.

Eight slivers contained on bobbings are placed in a creel, and their ends are brought forward on a carriage, working on a horizontal slide. The tufts of wool are taken by a comb having a backward and forward movement towards the revolving circular comb, on which they are placed by a descending brush. The ends of wool projecting on each side of the comb are guided by endless bands of leather; and the two slivers thus formed are drawn into one by a pair of fluted rollers through a hollow, revolving comb, and deposited in the coiling can. The waste wool remaining between the teeth of the comb is cleaned out in the usual manner, by means of triangular plates.

The principal exhibitors of ropes and cables are Messrs. Besnard and Genest (36), of Angers, Maine-et-Loire, who show a pyramid composed of wire and hempen ropes and cables for the Imperial and merchant navy; a coil of flat rope made from the fibres of the aloe, for the mines of Blanzy, 231 fathoms in length and weighing upwards of three tons; a coil of flat wire rope, weighing upwards of four tons and 260 fathoms in length, intended for the use of the mines at Creusot; a flat hempen rope, 300 fathoms in length and weighing upwards of five tons, with various other coils of cables of large dimensions for mining purposes, form the base of the pyramid. Upwards of 800 workmen are employed by this firm for the manufacture of cables and cordage, with an engine-power of 300 horses.

The machinery used by this firm has been chiefly furnished by Messrs. Combe, of Belfast, for combing hempen and other fibres, and the carding-engines of Fairbairn, of Leeds.

Some excellent samples of wire, hempen and rope, made from the fibres of the aloe, are exhibited by Messrs. Marcheteau, Potrales, and Laroche, of Angers (33).

The Commission des Ardoisières of Angers (98) show some good samples of both flat and round wire rope.

The generality of the cables and ropes in the French department is of excellent quality.

The principal exhibitors of card-clothing, separate parts of machinery, such as spindles, flyers, bobbins, gills, combs, used in the preparation of textile fabrics, are Messrs. Harding-Cocker, of Lille (120), Messrs. Scrives, of Lille (133), Messrs. Metcalfe, of Meulan, Seine et Oise (21), and numerous other firms.

The machinery for silk-throwing does not generally present any special features or novelties in construction.

Some excellent apparatus for weighing and testing the strength of silk, and parts of silk-throwing machinery, are exhibited by Messrs. Burdet (149) of Lyons, Mr. Alcan, of Paris (22), and a few other exhibitors.

ALGERIA.

In this section some effective cotton-gins are exhibited by M. Chanfourier, of Paris. They are adapted for opening and cleaning any kind of staple, whether long or short. The cotton is drawn between a pair of steel rollers, working nearly in contact, and so close as not to allow the passage of an ordinary sheet of paper, and which stop the passing of the smallest seeds which drop through the grating in front of the rollers. The fibres are drawn through by means of wooden rollers covered loosely with leather, which effectually prevent the cotton from being wrapped round the steel rollers. Another pair of leather-covered rollers placed at the back continue the drawing of the fibres through the gin and keep the first pair clean. The chief novelty introduced in this machine is a small fan which sends a current of air on the steel rollers and tends to keep them cool. The machines are cheap, and can be recommended for use in countries whose skilled labour is scarce, as they can be put in order by any person of ordinary intelligence.

HOLLAND.

The exhibitors in this department are few in number, and only show some samples of cables and cordage.

BELGIUM.

The manufacture of machinery for the preparation and spinning of textile fibres is most prosperous in Belgium. Verviers is the principal seat for the construction of woollen machinery, and Ghent for cotton machinery. Machines, both for cotton and wool, are constructed in large numbers at Liège.

A good assortment of cables and ropes of various kinds is exhibited by Vertongen Goens, of Termonde (13). In this town and in the neighbouring communes upwards of 3000 persons are employed in ropemaking.

M. Celestin Martin (5) exhibits a complete assortment of woollen machinery, consisting of opening-machine, set of carding-machines, and self-acting mule.

The first machine is for the purpose of opening and oiling the fleece previous to carding. It is provided with self-feeding apparatus somewhat similar to that described in connection with M. Mercier's machinery in the French department. The wool is opened by a revolving beater with iron blades, and passes on a travelling lattice to the oiling apparatus, which consists of a trough containing the oil which is tipped over in a slow and regular manner by a suitable arrangement of gearing, so that the requisite quantity of oil is poured out on to a revolving brush-roller, and in this manner the wool is sprinkled as it passes under towards a drum covered with short steel points, from which it is delivered in a fit state for carding.

This machine is of great importance for the preparation of wool for the manufacture of cloth and other woollen stuffs; a careless oiling of the fleece causes irregularities in the threads and unequalness in the cloth.

The set of three carding-machines consists of "scribbler," provided with self-feeding apparatus; the fleece is stripped in the usual manner from the doffer, by a vibrating comb, and formed into a sliver, which is wound into a ball. The "intermediate" card is supplied by forty of these balls of slivers, which are placed in a creel. The sliver delivered by this machine is of twice the size of the former and is wound into a ball. This ball serves to supply the "condenser," the end passing through an eye fixed in an upright is led through another eye, which is made to traverse, by means of an endless leather strap, for the purpose of folding the sliver backwards and forwards on the taker-in or feed-rollers. The fleece thus formed is divided into parallel strips by thin steel blades, which are stationary between the carding-cylinder and the doffer; the sixty-four strips and two wasters are then felted by being rubbed between two endless bands of leather stretched on pairs of rollers having an alternate transverse motion: the threads thus formed are wound upon rollers. This machine works about 150 lb. of wool per day.

The self-acting mule exhibited by M. Martin may be remarked for the great simplicity in the arrangement of the various parts of the headstock, and which are easily accessible in case of repairs.

Messrs. Houget and Teston, of Verviers (4), have a good display of machinery for preparing and spinning wool, consisting of scouring and rinsing machines, a burring and opening machine, with self-acting arrangement for oiling the fleece. The "lap," or fleece, formed by this machine is rolled continuously on a cloth which effectually protects it from any damage that might occur from carriage, whilst at the same time the evaporation of the oil from it is checked. The "scribbler" card is 44 in. in width, with five pairs of workers. The feeding-table is so arranged to take in the "lap," whilst the cloth is wound upon a roller underneath as the lap is unwound. The fleece is stripped in the usual manner from the doffer by a vibrating comb, and formed in a sliver, which is led by an endless feed-cloth to supply the "finisher" carding-machine by means of Apperley and Clissold's patent diagonal feeder.

Messrs. Rens and Colson, of Ghent (5), exhibit a throstle-frame for spinning flax.

The Société du Phenix, of Ghent (9), show a carding-machine, drawing-frame, and roving-frame of 112 spindles.

PRUSSIA AND THE STATES OF NORTHERN GERMANY.

The principal exhibitor in this department is M. Richard Hartmann, of Chemnitz, Saxony (209), who shows a very complete assortment of woollen and flax dressing machinery.

The wool-carding machinery consists of a double cylinder carding-engine, in which the wool is prepared for the "condenser," and formed into a sliver, which supplies the latter by means of Messrs. Apperley and Clissold's patent feeder. The shaft on which the stripping-comb is fixed is extremely heavy, and the arrangement tends considerably to diminish the vibration of the machine.

The arrangement of the apparatus for felting the threads is altogether novel. The endless leather aprons generally in use are replaced by a pair of leather-covered rollers, which are rotated by suitable gearing. An alternate motion is given to them by eccentrics, which can be regulated at pleasure, so that the rubbing may be more or less, as may be required for different qualities of yarn.

A self-acting mule of 180 spindles, for spinning wool, is also shown by Mr. Hartmann.

The flax machinery exhibited by this firm consist of "spreader" for long line. The endless succession of gill-bars is well arranged, so as to remedy the noise and wear and tear which ordinarily attend these machines by the too abrupt and violent descent of the faller. The body of the line in this machine is drawn out to from twenty-five to forty-five times its original length.

The second drawing is effected by a drawing-frame for six slivers. The proportion of drawing of the flax in this machine is from fourteen to twenty.

The roving-frame of seventy spindles for bobbins 8 in. by 4 in.

The carding-machine for tow is 6 ft. in diameter and 5 ft. in width, with six pairs of workers and clearers and three doffing-rollers. It is fitted with a bell arrangement for stopping the machine when from 300 to 600 yards of sliver have been delivered.

A drawing-frame with three heads for six slivers each. A throstle frame for wet spinning is also shown. It has 176 spindles. The drawing-rollers are in gun-metal, and the weighted rollers of gutta-percha.

Some excellent samples of wire and hempen rope and cables are shown by M. Heckel, of St. Johann, near Sarrebrück (7).

GRAND DUCHY OF BADEN.

Three exhibitors only send specimens of hempen and wire rope, also some cordage made from cotton.

BAVARIA.

The ropeworks of Flissen send some good samples of twine and fine cords.

AUSTRIA.

M. Giradoni, of Vienna (5), exhibits a double-carding machine for cotton; the arrangement of this machine is exceedingly novel, and a great economy of floor space is obviously gained in this manner. The carding-cylinders are placed one on the top of the other, instead of side by side, as is usually done. The workers and cleaners are placed round nearly the entire circumference of the carding-cylinders, and the space through which waste can be thrown off between the first and second carding-cylinders being thereby reduced. The fleece is delivered from the first or "breaker" cylinder, to the second, or "finisher," which is surrounded by a pair of rollers and breaker, with six smaller rollers underneath. The doffer and stripping-comb are of the usual construction, and deliver the finished sliver to the coiling-can. The fly from the first cylinder falls into a box, and the combings from the second cylinder drop out below the machine. The production is stated to be from 150 lb. to 220 lb. per day, with a total waste of from 4 to 5 per cent of raw materials used, fly, combings, and strippings included.

The other principal exhibitors from this country are Messrs. Hachnel, Manhardt, and Co., of Bielitz, Silesia (6), who show some good samples of card-clothing for woollen goods.

Messrs. Blumenstock, of Reichenberg (2), and M. Angeli, of Trieste, also exhibit good samples of card-clothing for cotton, woollen, and flax machinery.

SWITZERLAND.

The principal exhibitor from this country is M. Rieter and Co. (2), of Winterthur, who has a large display of cotton preparing and spinning machinery. The first and second machines are for the purpose of opening and cleaning the cotton as imported in bales, and forming it into a lap to supply the carding-machines. The carding is effected by two machines only—that is to say, double carded, with the intermediate process of lap-doubling. The "breaker" carding-machine is furnished with six working rollers and cleaners; the fleece is stripped from the doffer in the usual manner with a vibrating comb, and is contracted and drawn through a tube by means of a pair of rollers into a sliver, which is delivered and coiled in a tin can revolving slowly on its axis.

The lap-doubler is for the purpose of laying the slivers from the "breaker" side by side and forming them into a lap to supply the "finisher" card. Twenty-four cans containing the slivers are arranged on one side of the machine, each end passes through a guide provided with a self-stopping motion, so that in case any sliver should break, the machine is stopped and waste or spoiled work is prevented. The slivers then pass side by side between two pairs of calender rollers; and the lap thus formed is wound on a light wooden bobbin placed in the channel between two fluted rollers. Four of these laps, placed end to end, form a complete lap for the "finisher" card. This machine is fitted with twenty-four self-stripping flats on Wellmann's system. The fleece is stripped in the usual manner from the doffer by the vibrating comb, and drawn into a sliver, which is deposited in the coiling-can.

In the drawing-frame the fibres of the slivers are straightened and their substance equalised. This machine consists of three pairs of rollers, revolving at different speeds, through which four slivers are drawn into one, and two slivers thus formed are, by passing through a series of rollers, drawn into one; the single sliver thus formed of eight from the carding-machine is deposited evenly and compactly in the coiling-can. This machine is fitted with stop motion for stopping the machine should any of the slivers break.

The single slivers are next twisted, for the first time, in the slubbing-frame, into a coarse thread. This frame is of forty spindles. The slivers are passed from their cans and through three pairs of rollers, the top ones being covered with leather. The slivers then pass to the spindles arranged in a double row along the front of the machine. Each spindle is fitted at its upper end with a flyer, and the slubbing passes through its hollow arm to the bobbin. The spindle and bobbins revolve at different rates, the speed of the bobbin being gradually reduced as the diameter increases by being filled. This is effected by means of a pair of conical drums. The bobbin is lifted by a rack-and-pinion motion, so as to lay the slubbings on the bobbins in even coils. Two slubbings are next twisted together on the intermediate frame of seventy-two spindles; these are, in their turn, doubled and twisted into a roving, on the roving-frame of eighty spindles, which are finally spun on the self-acting mule.

Messrs. Wegmann and Co. (5), of Baden (Argau), exhibit some well-constructed "silk-throwing" machinery, consisting of winding and cleaning machines for the purpose of winding on bobbins the silk as imported in skeins, and of cleaning the silk at the same time. The skeins are placed upon swifts or reels, the diameter of which can be easily altered to suit the different sizes of the skeins, by sliding out the arms or spokes; the silk is passed between the edges of steel cleaners, consisting of a slit between two steel bars, which is adjustable by screws, to pass the maximum thickness allowed, and to stop fibre of extra thickness. The silk is wound on bobbins, driven by friction of light iron pullies, and is traversed on them by means of a slide rod, having an alternate motion, and carrying small glass rings, through which the silk is guided to the bobbins.

The fibres of silk are next wound and laid evenly together in the doubling-machine previously to their being twisted together in the throwing-machine.

Two throwing-machines are exhibited, one for spinning warp and the other weft; also a machine for spinning sewing-silk. All these machines are provided with a self-stopping arrangement, in case of breakage of threads.

Some good samples of card-clothing are exhibited by the Fabriques Mécaniques, of Ruti, Zurich (3).

M. Honegger (6), of Wetzikon (Zurich), show various parts of spinning machinery, such as spindles, flyers, &c.

SPAIN, PORTUGAL, AND GREECE

make but a poor show in this class, and exhibit only a few rude spinning-machines and samples of cordage.

SWEDEN AND DENMARK

show excellent samples of cordage from the Etablissement de la Marine, at Carlskrona (1), Messrs. Hoffman and Co. (2), of Stock-

holm, Messrs. Holm and Son, of Copenhagen (1). and M. Thrane and Co. (2) of the same place.

RUSSIA.

Some excellent samples of rope and cables are exhibited by M. Cazalet, of St. Petersburg (1); the Dockyard of Cronstadt (2); Jouravleff, of Rybuisk (3); and the Auxiliary Committee of the Caucase, at Tiflis (6), who send specimens of rope and cordage made from bass fibres, wool, and wild hemp.

ITALY.

Although the cotton trade is daily becoming more developed in this country, it is a matter of surprise that no preparing or spinning machinery is exhibited.

Ropemaking by machinery in Italy has made but little progress, and the old-fashioned wheels are still used for spinning the yarn and twisting the strands. The combing and preparing of flax and hemp is chiefly performed by hand.

Some well-made machines for winding the silk off from the cocoons, with the usual basins for hot water heated by steam, is exhibited by Messrs. Cariboni (4), of Como; Bataglia, of Varese (5); and Messrs. Traverso, of Alessandria (1).

TURKEY AND EGYPT.

The specimens of rope and cordage and a few spinning implements of rude construction do not require any particular comment.

UNITED STATES OF AMERICA.

The contributions from the United States are rather scanty, and consist entirely of preparing machinery for cotton and wool, for which no particular novelty can be claimed.

Mr. H. L. Emery, of Albany, New York (4 and 6), exhibits two sawgins of similar construction, the small one being worked by hand. In this machine the circular saws are mounted, about an inch apart, on a cylinder, and project about half an inch through a grate in the hopper, or box where the cotton is fed in. In the hopper is a light wooden shaft thickly studded with pointed wooden teeth, revolving freely, for the purpose of presenting the cotton to the action of the saws without pressing; a brush cylinder revolving in a contrary direction clears the saws, and at the same time creates a strong draught. Across the discharging side of the gin is placed a large revolving cylinder of perforated zinc through which the current of air caused by the brush cylinder passes, carrying with it the dust which passes out at the ends. The cotton deposited on the cylinder is stripped by means of a pair of delivery rollers.

The Southern Cotton Gin Company, of Bridgewater, Massachusetts (5), exhibit a 60-saw gin, with brush cylinder.

A somewhat similar machine is exhibited by Messrs. Bates, Hyde, and Co. (2), of Bridgewater, Massachusetts, worked by hand.

Mr. Goddard (3), of New York, exhibits a "Mestizo burring-picker," in which the wool is shaken and beaten till all the burrs fall away. The wool is fed in on an endless lattice, between two taker-in rollers, covered with hook-shaped teeth, to the beater cylinder, covered with bars armed with small teeth, making about 400 revolutions per minute. The wool is then delivered to a smaller cylinder, covered with Garnet's cards, making about 550 revolutions per minute. The wool is stripped from the burring-cylinder by a brush roller revolving at the rate of 900 turns per minute; and the fleece is oiled by a revolving brush upon which oil is constantly dropped. The dust is extracted from the wool through the perforated zinc casing over the cylinder by means of an exhausting fan draught. The production of this machine is stated to be about 1000 lb. per day.

GREAT BRITAIN.

Messrs. Platt and Co., of Oldham (15), exhibit a complete set of machinery for preparing and spinning cotton and wool. For the purpose of separating the staple from the seed they use the Macarthy gin, the principal feature in which is a roller from 4 in. to 5 in. in diameter, built up of the fibres of jute, in the same way as a brush, and compressed in such a manner as to nearly resemble pasteboard. This roller revolves in front of a hopper, into which the cotton to be cleaned is thrown; the bottom of the hopper is a grating sloping towards the roller, in front of which is placed a thin steel plate, pressing gently against it. The fibres of the cotton are seized and drawn under this plate by the revolving action of the roller until the seeds come in contact with it. A vibrating knife then ascends, and, passing the edge of the plate, pushes off the seeds, which drop through the grating, and the fibres, thus freed, are delivered on the other side.

The cotton is then spread upon the endless feed-table of the scutching-machine, where it is opened, and freed to some extent of dirt, by a beater revolving in a casing fitted with a series of parallel blades, and with longitudinal slits between the blades through which the dust falls. The cotton then passes to a series of cylinders covered with wire gauze, through which the dust is drawn by the partial exhaustion of the air inside, by means of a fan. The cotton is stripped from these cylinders by iron rollers, and formed into a "lap," and partially felted, by being passed between two pairs of calender rollers.

Two carding-machines are exhibited by this firm, one with 45½-in. cylinder, with six pairs of working rollers, and adapted as a single carder for coarse numbers, or, as a "breaker," for preparing slivers for the "finisher."

The other has a cylinder of the same diameter, and is fitted with a pair of working rollers and an endless chain of self-stripping flats. It is specially adapted as a "finisher" for cotton of fine numbers.

A combing-machine is also shown, for laps of cotton 16 in. in width; the tuft of cotton from the lap placed at the top of the machine is taken by a pair of nipping jaws and held against a revolving comb, which combs out the short fibres; both ends of the tufts are combed and deposited on a doffing-cylinder, in such a manner as the ends are made to overlap each other, and are reunited in a continuous sliver, which is afterwards deposited in a coiling-can on one side of the machine.

The drawing, slubbing, and roving frames of these makers are of excellent construction, and are fitted with the latest improvements.

Two self-acting mules, one for spinning cotton and the other wool, are shown at work. These machines are of the most improved construction, the cam-shaft is driven by conical frictional pulleys, a patent governor or cop-regulator is attached for the purpose of adjusting the winding-on motion to the form of the cop, and it is perfectly automatic in its action. The drawing-out motion is provided with an arrangement for stopping, in case of obstruction to the free traverse of the carriage, thereby preventing breakage of bands and other damage to the machinery.

In the throstle-frame exhibited by this firm the common flyer is replaced by the ring and follower. More yarn is produced by this machine with a smaller number of spindles than by the mule, as they can be driven with a greater speed, but the twist is not so regular.

Messrs. Lawson and Sons, of Leeds (11), exhibit some highly important machinery for the preparation and spinning of flax. The carding-machine is of considerable weight and importance; the main cylinder, or swift, as it is sometimes called, being 5 ft. in diameter, and 6 ft. in width, and is surrounded for the greater part of its circumference by working rollers. The tow is supplied on an endless feed-lattice, and is stripped from the main cylinder by three doffing-rollers, each furnished with stripping-combs, and the three slivers thus formed pass to their respective coiling-cans.

The other machines connected with the preparation of flax consist in drawing-frame, spreader, roving-frame of seventy-two spindles, and a spinning-frame of 200 spindles. These are all of excellent workmanship and design.

Messrs. Combe and Co. (5), of Belfast, also exhibit some good flax machinery, consisting of hackling-machine, roving-frame of fifty spindles, and yarn-reels for winding off lengths of yarn.

The sheets of the hackling-machine are vertical, and the hackle-stocks are fixed on the sheets instead of on bars, as is generally the case, and in this way they run more lightly and with less noise and vibration.

The principal feature in the roving-frame is the use of the expanding pulley in place of the conical drum for varying the speed of the bobbin as the yarn is being wound on. This ingenious contrivance for obtaining a variable speed is the invention of Mr. Combe, and consists of two interlocking cones, with the driving-strap running in the groove so formed. An arrangement of left and right handed screws parts or brings together the cones, thereby varying the diameter of the working groove, and, consequently, the speed of the bobbins; and a steadier motion is obtained than with the conical pulley, a matter of great importance in twisting the long fibres of flax slivers.

Messrs. Wren and Hopkinson, of Manchester (17), show some highly-ingenious machinery for winding sewing-silk on cards, and for reeling cotton.

Mr. Ferraber (7), of Gloucester, exhibits his patent and improved wool-carding machinery, applied to a set of two carding-machines constructed by Mr. Tatham, of Rochdale. The fleece, being stripped in the usual manner from the doffer of the "scribbler," is taken by a system of travelling-aprons, one working at right angles to the other; the fleece by this means is deposited in diagonal folds, crossing each other alternately on an endless apron working at right angles to the axis of the machine, and forming a continuous narrow band about 12 in. in width, which is carried forward mechanically and laid, without stretching, in diagonal folds, one overlapping the other, in a continuous and uniform "bat" of the required thickness, on the endless feed-lattice of the "condenser," where the fleece is divided into a series of parallel strips, which are slightly felted in their passage between two endless leather aprons having an alternate motion across them. The threads are then wound on rollers.

APPARATUS AND PROCESSES USED IN THE MANUFACTURE OF FURNITURE.—Class 58.

BY LIEUT. OSBERT CHADWICK, R.E.

The machinery and processes of this class present no great novelties in principle, the chief improvements being in detail and arrangement.

In the English section nothing is exhibited; but as there are in class 54 some machines applicable to the processes to be here described, they will be mentioned, so as to afford comparison with those performing similar operations, which in the French section are placed in class 58.

For the same reason some German machines are also included. The following objects are those which will probably be of greatest interest. They are arranged in the order in which they are given in the French general catalogue, as being that by which they are most easily found:—

FRANCE.

Perin: Endless ribbon saws, and specimen of work done by them.
Gèrard: A planing-machine; also circular and reciprocating saws
Arby: Planing-machine.
Barrère and Caussande: Engraving-machine and copying lathe.
Contamin: Copying lathe.
In the Park.—Cart: Portable saw frame for rough timber, with endless band saws.

HESSE.

Schmaltz Brothers (54): Machine for shaping pieces for parquet floors.

AMERICA.

Whitney's gauge lathe for legs of chairs, &c.
Whinslow: Double serpentine moulding-machine.

ENGLAND.

Worssam: Radial boring-machine; general joiner.
Robinson: Moulding-machine; self-acting cross-cut saw-bench; tenoning-machine.
Powis, James, and Co: Moulding-machine; boring and mortising machine; combined endless and reciprocating sawing-machine.

Sawing-machines.—Perin, who was the introducer, if not the inventor, of the endless band saw, shows a fine saw of this kind for cabinetmakers' use. Also, a combined reciprocating and band saw machine for inlaying. The endless saw runs over three small pulleys, one of which is provided with an arrangement for tightening the saw. The reciprocating saw works in slides, above and below the table, and is stretched by a spiral spring attached to the upper slide by a leather strap. A small boring-spindle is placed at one side of the table, at the front of which is a vice for holding the saw while being sharpened, during which operation the band saws are placed over two pulleys, provided for the purpose.

M. Perin also shows a fine specimen of the work that can be executed by these saws. Powis, James, and Co. also show a similar machine, but of larger dimensions. In this machine the wood packing round the saw beneath the work is independent of the table, which can therefore be inclined if required without loss of time from having to fit new packing.

M. Cart has a portable saw frame for sawing rough timber, with two endless band saws.

Gèrard shows a small circular saw driven by the foot, which is adapted for all kinds of light work. The table is provided with a slide, with gauges for mitre joints. For rebating, the whole table can be inclined, so that the saw protrudes to any required extent; for bevelling, half the table turns down on a hinge in the prolongation of the saw, and can be fixed at any angle. A sweep-cutting saw is shown by the same exhibitor, the framing of which is entirely of wood. The saw works between arch-heads, and is tightened by a simple lever, which strains the flat chain connecting the opposite ends of the levers which carry the saw. A self-acting crescut saw by Robinson has an arrangement by which the circular saw moves backwards and forwards in a slit in the table, advancing slowly and returning quickly after making the cut.

Whitney (United States) exhibits a circular saw table, with a crescent and a ripping saw, so arranged that either can be brought into play without loss of time. The two saws are supported at each end of a lever carried by an axle in the middle of its length. Thus either saw can be brought up through the opening in the table, and the driving-belt is taken up by the pulley of the saw that is uppermost. One half the table is made to slide, and is provided with gauges to cut any angle. The other half is fixed, and is provided with a fence.

The circular saws which are provided with apparatus for boring, mortising, &c., will be mentioned afterwards.

Planing and Moulding Machine.—In the planing-machine of Arbey the cutters are in the form of a screw; there are three, and each makes rather more than one third of a turn. To ensure the cutters being sharpened to proper form so as to cut a flat surface, a self-acting grindstone is attached to the machine. The stone is carried by a frame which traverses across the machine parallel to the axis of the cutter-block, which is for this purpose disconnected from the driving-pulley. On the lower part of this traversing frame, immediately under the grindstone, is a rest against which the face of the cutting-blade is pressed by a weight attached to a pulley on the spindle. The grindstone is moved backwards and forwards across the machine by a screw, while the cutter, from its form, is caused to revolve by the pressure of the rest. In this manner a true helical form is given to the edge. The work is clamped to the table, which moves at the rate of about 12 ft. per minute under the cutter. For planing thin boards the table may be fixed, and the feed is then given by a roller.

Gèrard: This planing-machine consists of a vertical disc, pierced with two radial slits, through which the edges of the cutters protrude; they are straight, and exactly similar to an ordinary plane-iron. The work is carried by a table in front of the disc, which revolves at a comparatively slow rate.

The moulding-machine shown by Robinson (class 54) has four cutter spindles, so that the four sides of the work can be finished at one operation. The upper cutter-spindle can be set slanting, so that, for a moulding much deeper at one side, the cutter need not have such a great difference in size between the two ends. The feed-rollers are driven by an endless screw, and, to adjust them for differences in thickness of the work, their axles move in a circular arc, whose centre coincides with the centre of the driving-wheel, so that they are always in gear. In a similar machine by Powis, James, and Co. the cutter-spindles for the edges of the board can be inclined at any angle, so as to enable them to tongue and groove the edges of boards for cylindrical work, such as cylinder lagging. In this machine the rate of the feed can be changed even while working. The feed-rollers are worked by a friction-pulley which presses against the face of a revolving disc. This friction-pulley can be moved along its axle from the centre of the disc to the circumference, or can be removed altogether from contact, so that the rate of feed can be changed to any required extent.

In Whitney's cylinder plane the horizontal cutter-spindle is fixed, and the table is raised or lowed to accommodate different thicknesses of plank by a a simple arrangement. On the under side of the table is an inclined plane, which rests on a wedge. This wedge is moved in or out by means of a screw; and, as the table cannot move horizontally, it is raised or lowered. One turn of the screw raises the table one eighth of an inch.

Whinslow's double serpentine moulding-machine is designed to mould pieces of an irregular curved shape, such as the backs of chairs or sofas. The cutter-spindle is horizontal, and beneath it, and supporting the work, is a fluted roller. The flutes of this roller are slightly oblique, so as to press the work against a stop projecting from the frame. This pressure causes the work in passing under the cutter to follow any outline to which it may originally have been cut. It is pressed down into the fluted roller by two rollers, one on either side of the cutter. The cutter is made up of small irons, each of which is held in undercut grooves in the edges of two rings placed on the spindle, and tightened by a nut. By this means several mouldings can be made with the same irons by changing their relative positions, and the whole is better balanced.

Schmaltz Brothers, Hesse (class 54), exhibit a machine for parquet flooring which may, perhaps, be classed under this head. Its object is to shape, tongue, and groove the edges of the geometrical figures for this kind of floor. The tool is carried by a vertical spindle, and the work is fixed to a circular table, supported by a slide rest. This table also turns on a vertical axis, and can be turned round through 30, 45, 60, or 90 degrees, and then fixed by a stop, which enters into notches in its circumference. By this means accurate hexagons, octagons, &c., are cut and the edges grooved.

Vanloo, France (5). This machine produces ribbed, beaded, and basket-work patterns of various sorts. A table carrying the wood to be carved moves backwards and forwards under a frame carrying the tool; on each side of this table is a rack, the projections of which act on a sort of cam fixed to the lower side of the frame carrying the tool, causing it to pass over the work with a jumping movement. The form of the cam and the shape to which the edge of the cutter is ground determine the pattern. For some patterns a horizontal movement of the cutter is also required. For this purpose a rack is fixed on the side of the table, and acts on a cam on the frame, as before. The tool cuts both ways, and the motion of the table is self-acting.

The universal moulding, shaping, and recessing machine of Worssam and Co., England (class 54), is one which may be taken as intermediate between the moulding and the boring machines. The vertical cutter-spindle is carried by a frame which overhangs considerably, so that the work can pass under the tool; and thus it is enabled to work in the centre of a board. For sinking recesses to pattern, a table, carrying the work and pattern, is added, which can be moved by hand in any direction on two slides at right angles to one another. This machine has also a second cutter-spindle, which works below the table, and is brought up by a hand lever. This cutter revolves in an opposite direction to the top one.

Mortising and Boring Machines.—Of these machines two kinds are exhibited, one with a revolving cutter and the other with an ordinary mortise chisel with a reciprocating motion. Of the first kind a machine is exhibited by Gèrard. The spindle is horizontal, and can be raised or lowered according to the position of the mortise to be cut. The work is traversed, and the spindle brought up by racks and pinions. To prevent the lever handles being sometimes in an inconvenient position, these pinions are loose on their shafts and can be slid out of gear with the rack and brought to a more convenient position. In the similar machine of Perin there is a second spindle, parallel to the first, which does not revolve, but carries a double-edged fork-shaped cutter for finishing the ends of the mortise, which are left round by the revolving cutter. Similar machines are exhibited by Schmaltz and Geschwind, and Zzimmermann. Of the machines with the reciprocating chisel one is shown by Rogers, United States. The chisel is moved by a crank and connecting-rod; and, with crank-shaft and driving-pulley, is brought down to the work by the pressure of the foot applied to a treadle, and raised from it by a weight. When the chisel is allowed to rise to the top of its slide it is turned half round by a stud, which strikes a spiral cam, so as to cut the other end of the mortise; a similar cam turns the chisel back again when brought to the bottom of the slide.

Tenoning-machines.—Roger's tenoning-machine, United States, has two horizontal cutter-spindles, with open cylindrical cutter-heads, which are provided with a small saw spur to cut the shoulder of the tenon. The table carrying the work is raised or lowered by four wedges. The cutter-spindles have independent horizontal adjustments, so that a tenon of unequal depth on the two sides can be cut if required. A similar independent adjustment is seen in Robinson's machine.

Machines performing several operations.—Worssam's "general joiner" does sawing, planing, and thicknessing; mortising, tenoning, cross-cutting, and squaring up; tonguing, rabbeting, grooving, moulding, and beading; chamfering, wedge-cutting, and boring. The saw fence can be inclined at any angle, and the table rises and falls, so that any depth of cut may be taken. For planing, a planing disc replaces the saw. Tenons are cut with a double saw, the work being fixed in a clamp which slides along the fence. For grooving, a "drunken saw," or one set obliquely on its spindle, is used. For mortising, boring, or moulding, the tool is fixed on the opposite end of the spindle to the saw, and the work is carried by a sliding plate, working upon a table with an independent rising and falling motion, so that boring can be carried on at the same time as sawing.

A similar machine is shown by C. Powis. Robinson's circular saw bench for tonguing, grooving, boring, cross-cutting, and sawing is somewhat simpler. The saw-spindle rises and falls instead of the table. For grooving, a cutter is employed, replacing the saw. For boring, the auger is attached to the end of the spindle, and the work is carried by a separate table. It is considered better, when expense is not considered, to have a separate machine for mortising, as the motion of the wood in this operation produces a lateral strain on the spindle, which is apt to derange it for planing or sawing.

VARIOUS MACHINES.

Barrère et Caussande exhibit a machine for engraving. This machine is chiefly intended to produce and engrave the complex patterns which are used in bank-notes. It engraves circles, ellipses, circular and elliptical rosettes. There is also an apparatus for producing small stars at regular intervals, forming thus the ground for bank-notes. It also engraves automatically from the originals or casts, by the "anaglyptographic" process, medals, &c.

A copying-lathe for medals is also shown by the same exhibitors. In this machine the work and the original revolve slowly, at the same speed. A tracing-point moves slowly from the circumference of the model, so as to describe a spiral track over the surface to be copied, and rises or falls as meets the elevations or depressions. The vertical motion of this point is communicated to a drill, which moves in a similar manner over the work. Reduction or enlargement is produced by causing the horizontal movement of the drill to be slower or faster than that of the tracing-point, by means of change-wheels. Contanrin has a similar machine, but the movements are produced entirely by levers.

Whitney's gauge-lathe finishes at one operation the legs and rounds of chairs, &c. It is a lathe with a slide rest traversed by a screw. This rest carries two tools; one, a chisel, is fixed and roughs off the work. The second, a V-shaped cutter cuts out the pattern, and is guided by a template fixed to the bed of the lathe. A knife, whose edge is moulded to the form to be produced, moves vertically in a frame behind the lathe, as the slide-rest passes along, this knife descends and smooths off the pattern produced by the first two cutters. In this manner chair legs are produced from a rough square log with an accuracy equal to that attained by hand, and with immense rapidity.

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